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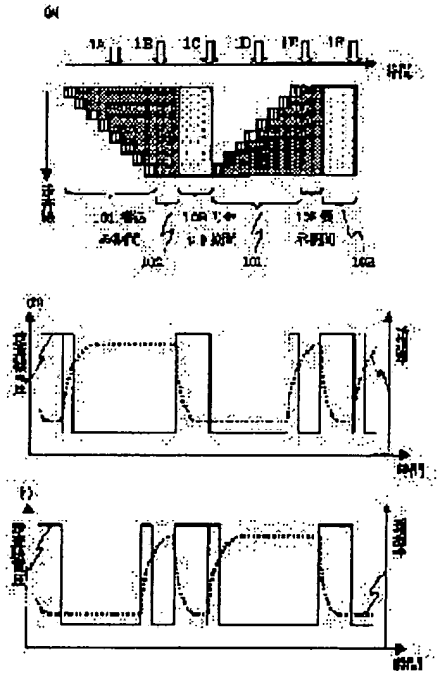
(54) DRIVING METHOD OF LIQUID CRYSTAL DISPLAY DEVICE AND LIQUID CRYSTAL DISPLAY DEVICE USING THE METHOD

(57)Abstract:

PROBLEM TO BE SOLVED: To obtain a uniform in-surface luminance distribution and excellent contrast.

SOLUTION: In a 1st field, odd-numbered scanning lines are scanned in order from the top to the bottom in a write period 101, displayed in a display period 102 and reset together in a reset period 103. In a 2nd field, even-numbered scanning lines are scanned in order from the top to the bottom in the write period 101, displayed in the display period 102 and reset together in the reset period 103. Since the period from the writing to the resetting is made uniform in a display panel surface, a uniform in-surface luminance distribution is obtained and a flicker is reduced.



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CLAIMS

[Claim(s)]
[Claim 1] The drive approach of the liquid crystal display characterized by scanning the scanning line one by one for every field, displaying a screen, resetting all at once in the drive approach of the liquid crystal display which resets the scanning line succeedingly after scanning the scanning line one by one in the 1st field, and resetting all at once [after scanning to the order of a scan and the reverse order in the 1st field in the 2nd field following this 1st field].
[Claim 2] The drive approach of a liquid crystal display given in the claim 1 characterized by performing the interlace drive which makes one frame said 1st field and 2nd field.
[Claim 3] The drive approach of a liquid crystal display according to claim 2 characterized by having 2 times of write-in periods with the one scanning line in one frame.
[Claim 4] The drive approach of a liquid crystal display according to claim 3 characterized by having 2 times of reset periods with the one scanning line in one frame.
[Claim 5] The drive approach of a liquid crystal display according to claim 3 which has 1 time of a reset period with the one scanning line in one frame, and is characterized by being smaller than the absolute value of the data signal electrical potential difference at the time of the writing whose absolute value of the data signal electrical potential difference at the time of the 1st writing after reset is the 2nd time.
[Claim 6] The drive approach of the liquid crystal display characterized by being the approach of driving the field sequential liquid crystal display with which the information on three colors is displayed one by one into one frame, and driving each foreground color by the approach according to claim 5.
[Claim 7] The drive approach of the liquid crystal display characterized by being the approach of driving the field sequential liquid crystal display with which the information on three colors is displayed one by one into one frame, and driving each foreground color by the approach according to claim 1.
[Claim 8] The liquid crystal display characterized by having the liquid crystal driven by the drive approach shown in claims 1-5.
[Claim 9] The liquid crystal display characterized by having the liquid crystal driven by the drive approach shown in claims 6 and 7.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to the drive approach of a liquid crystal display, and a liquid crystal display.
[0002]
[Description of the Prior Art] The mainstream of a high performance liquid crystal display is the TFT (thin film transistor) method active-matrix liquid crystal display in TN (Twisted Nematic) mode in which current and a nematic liquid crystal are used, or IPS (the Inn plane switching) mode. In these active-matrix liquid crystal displays, in order that a picture signal may write in positive/negative by 30Hz, it is usually rewritten by 60Hz, and the time amount of the 1 field is about 16.7ms (ms). Here, the sum total time amount of both positive/negative is called one frame, and is about 33.3ms. On the other hand, the response time of the present liquid crystal is this frame time extent also in the quickest speed of response. For this reason, when displaying the video signal which consists of an animation, or in displaying a high-speed computer image, a speed of response quicker than current frame time is needed.
[0003] On the other hand, in order for a liquid crystal display to aim at the further highly minute-ization, the field sequential color liquid crystal display which changes the back light which is the illumination light of a liquid crystal display to red, green and blue, and a time amount target is examined. Since it is not necessary to arrange a color filter spatially by this method, 3 times [over the past] as many highly-minute-izing as this is possible. In a field sequential liquid crystal display, since it is necessary to display one color by one third of the time amount of the 1 field, the time amount which can be used for a display is set to about 5ms. Therefore, the liquid crystal itself is asked for the response time shorter than 5ms. Use of the liquid crystal which has spontaneous polarization like a ferroelectric liquid crystal or antiferroelectricity liquid crystal as liquid crystal which can realize such a high-speed response is considered. Moreover, also in the nematic liquid crystal, the improvement in the speed by thin-film-izing [which makes viscosity low], or changing liquid crystal orientation into the orientation of a pie mold etc. which enlarges a dielectric anisotropy is considered.
[0004] The time amount by which an electrical potential difference and a charge are actually written in the liquid crystal section with a active-matrix liquid crystal display component is only the selection time amount (write time) of each scanning line. This time amount is about 5 microseconds, when in the case of the liquid crystal display which has 1000 Rhine and is written in by 1 field time amount it is 16.7 microseconds (microsecond) and performs a field sequential drive. In the present condition, the use gestalt of a liquid crystal device or liquid crystal which a response ends in such time amount hardly exists. In the liquid crystal device which has above-mentioned spontaneous polarization, or the accelerated nematic liquid crystal, the component which carries out such a quick response is not known. Consequently, the following problems occur. That is, the response of liquid crystal will usually break out after write-in termination of a signal. Consequently, it is if the electrical potential difference of liquid crystal layer both ends falls rapidly in the liquid crystal which has spontaneous polarization since the anti-electric field by rotation of spontaneous polarization occur. For this reason, the electrical potential difference written in the both ends of a liquid crystal layer changes a lot. On the other hand, change occurs in the maintenance electrical potential difference which writes in a liquid crystal layer and should be held since capacity change of the liquid crystal layer according to the anisotropy of a dielectric constant also in a high-speed nematic liquid crystal becomes very large. It becomes insufficient writing in the fall of such a maintenance electrical potential difference, i.e., the fall of effective applied voltage, and it reduces the contrast of a screen.
[0005] When the same picture signal continues being written in over several frames from the frame from which the picture signal changed from PERT 1 of the 36th volume of Japanese applied physics, and No. 2 720 pages to 729 pages, and the absolute value of a signal level changed, the purport as which the phenomenon called a "step response" is regarded is indicated. To the same signal level, this phenomenon is a phenomenon in which permeability carries out

vibration of light and darkness for every field over several frames, and is stabilized in the fixed amount of transmitted lights several frames after.

[0006] The example of the above-mentioned phenomenon is explained with reference to the mimetic diagram of drawing 16 . This drawing (a) is a wave form chart of a data electrical potential difference, and (b) is the wave form chart of the permeability at that time. If the data electrical potential difference of drawing 16 (a) is impressed to liquid crystal, like drawing 16 (b), permeability carried out vibration of light and darkness for every field, and it has settled in fixed permeability at last by the 4th frame in the example shown here. Thus, since several frames are needed for an actual permeability change, the rapidity of a display image is lost.

[0007] The permeability after a liquid crystal response is decided not by the impressed signal level but by the amount of charges stored in the liquid crystal capacity after a liquid crystal response. This amount of charges is determined by the stored charge before signal writing, and the write-in charge written in newly. Moreover, the stored charge after this response changes also with pixel design values, such as a physical property value of liquid crystal, an electrical parameter, and storage capacitance. For this reason, in order to take correspondence of a signal level and permeability, the information for writing in with (1) signal level and calculating correspondence of a charge, stored charge before (2) writing, and stored charge after (3) responses, actual count, etc. are needed. Consequently, the count section of the frame memory for memorizing (2) over a full screen, (1), and (3) is needed. This causes increase of the number of components of a system, and is not desirable.

[0008] As an approach of solving the above-mentioned problem, the reset pulse method for impressing the reset electrical potential difference arranged with a predetermined liquid crystal condition is often used before new data writing. According to this reset pulse method, since it is surely in the predetermined condition at the time of the writing of new data, correspondence of 1 to 1 is seen between the written-in signal level and the permeability obtained. By this correspondence of 1 to 1, while the generating approach of the signal for a drive becomes simple, means, such as a frame memory which memorizes the last write-in information, become unnecessary.

[0009] The method of generating a forward and negative data signal electrical potential difference to a fixed picture signal as the another impression approach of a reset electrical potential difference, impressing a negative (forward) electrical potential difference, after impressing a forward (negative) electrical potential difference, and impressing a reset electrical potential difference after that is also used. In this case, if the data signal electrical potential difference of positive/negative with the equal amplitude is impressed simply, the above-mentioned "step response" will arise. Then, impression of a data signal electrical potential difference which has the wave shown in drawing 17 (a) is performed. Drawing 17 (b) is the wave form chart of the permeability then obtained. The wave shown in this drawing by the dotted line is a wave of the permeability when impressing the wave of the data electrical potential difference at the time of making the amplitude equal by positive/negative, and its wave.

[0010] In order to prevent a "step response", as shown in drawing 17 (a), the amplitude of the data electrical potential difference in the first half of a frame (here forward data electrical potential difference) is set up low, and the amplitude of the data electrical potential difference in the second half of a frame (here negative data electrical potential difference) is made to be the same as that of the wave of a dotted line. A step response is prevented by this, and as shown in this drawing (b), the first half of a frame and the permeability same in the second half are obtained. Liquid crystal is arranged with the condition that predetermined reset was made, by resetting at the time of next frame termination. With the following frame, correspondence of 1 to 1 called fixed permeability is obtained to a fixed signal level by newly impressing the same wave.

[0011]

[Problem(s) to be Solved by the Invention] the conventional reset pulse method -- the above -- even if it adopts which reset pulse method, the following problems exist. It is a problem from which brightness changes with the locations in a screen a lot first according to the timing which resets. For example, if it resets after [all] the Rhine scan termination when scanning one by one toward the lower part from the screen upper part, in the screen upper part, reset will be performed by the bottom of screen to the display time after the writing for the about 1 field being acquired, without writing in and acquiring only behind slight display time. This phenomenon is explained with reference to drawing 14 .

[0012] Drawing 14 (a) is drawing typically displayed by two-dimensional according the condition of each period of the write-in (scan) period 101, the display period 102, and the reset period 103 to the scanning direction and time-axis of a screen. It has the eight scanning lines, a scan is performed one by one from the screen upper part in the write-in period 101 in the lower part, it results after a fixed display period 102 at the reset period 103, and this drawing shows the purport by which a full screen is reset at once. Drawing 14 (b) shows typically the scanning-line electrical potential difference and permeability on the scanning line of the screen topmost part at the time of performing a white display using such a drive approach, i.e., No. 1, (1 Motome). Moreover, this drawing 14 (c) shows typically the scanning-line electrical potential difference and permeability on the screen bottom, i.e., the scanning line of No. 8 (8 Motome). Although a white display is obtained with the scanning line of No. 1 in the comparatively long period excluding the

reset period and the standup period of a response from the one-frame period, since reset starts in response termination and coincidence, a white display is hardly obtained with the scanning line of No. 8. Consequently, if it sees in the whole frame period as shown in drawing 15 (b) when the same signal is displayed, the phenomenon in which it is bright in the screen upper part, and a bottom of screen is dark will occur. Such field internal division cloth reduces image quality remarkably.

[0013] Next, since the period changed into a predetermined display condition always exists, there are the whole contrast and a problem that the maximum permeability decreases. For example, when changing into the condition of a black display by reset, the period when predetermined displays other than a black display are obtained decreases compared with the case where it does not reset, and the maximum permeability and the permeability of each gradation decrease. On the other hand, since the permeability at the time of reset is added at the time of a black display and it is averaged in time when changing into conditions other than a black display by reset, the permeability of a black display rises and contrast falls.

[0014] Moreover, since the period which becomes fixed permeability always exists, there is a problem that a flicker occurs between the permeability and other display permeability. For example, since a full screen flickers to coincidence in resetting the whole screen surface to coincidence, a flicker is recognized violently.

[0015] Furthermore, there is a problem that a scan period becomes short by the reset period. Usually, a scan period (write time) is almost equal to what divided the field time amount which is the time amount of the one half of frame time by the scanning-line number. However, if a reset period is established into field time amount, the scan period 101 shown in drawing 14 (a) will become what divided what lengthened the reset time 103 by the scanning-line number (8) from field time amount. Consequently, a scan period becomes short. As a means for a reset period to solve the problem which affects a scan period, the technique of combining an interlace drive and reset is indicated by JP,4-186217,A. By this approach, the FLC (ferroelectric liquid crystal) panel is driven by the interlace mode, and the scanning line in a non-display period is reset. Thereby, reduction of the scan period by the reset period is prevented. Moreover, since the period of reset of adjacent Rhine shifts, it is thought that a flicker decreases by equalization. However, luminance distribution in a field, reduction of the maximum permeability, etc. which are other problems do not improve by this approach, either.

[0016] Even if a reset pulse is used for the purpose of this invention with the liquid crystal display of a high-speed response in view of the above, there are few dispersion and the flickers of the brightness within a field, and it is offering the drive approach of a liquid crystal display high contrast and high brightness being obtained.

[0017] the high-speed response the above-mentioned drive approach was used for whose purposes of other of this invention -- dispersion within a field and the flicker of brightness -- few -- high contrast -- high -- it is offering a brightness liquid crystal display.

[0018]

[Means for Solving the Problem] It is characterized by for the liquid-crystal drive approach of this invention to scan the scanning line one by one for every field, to display a screen, they to reset it all at once in the drive approach of the liquid crystal display which resets the scanning line succeedingly, after it scans the scanning line one by one in the 1st field in order to attain the above-mentioned purpose, and to reset all at once [after scanning to the order of a scan and the reverse order in the 1st field in the 2nd field following this 1st field].

[0019] Since time amount until it results [from writing] in reset is equalized in the field of a display panel according to the liquid crystal drive approach of this invention, the uniform luminance distribution within a field is acquired.

[0020] In case an interlace drive is performed by the drive approach of this invention, it is desirable to scan the scanning line of No. odd one by one from a top to the bottom by the 1st frame, and to scan the scanning line of No. even one by one upwards from the bottom by the 2nd frame.

[0021] It is also the desirable modes of this invention to face to perform an interlace drive and to have 2 times of write-in periods with the one scanning line in one frame and to have 2 times of reset periods. Here, it has 1 time of a reset period with the one scanning line in one frame, and it can constitute so that smaller than the absolute value of the data signal electrical potential difference at the time of the writing whose absolute value of the data signal electrical potential difference at the time of the 1st writing after reset is the 2nd time.

[0022] The liquid crystal display of this invention is a liquid crystal display which adopts the liquid crystal drive approach of above-mentioned this invention, and the operation and effectiveness corresponding to this invention approach are acquired.

[0023]

[Embodiment of the Invention] Hereafter, with reference to a drawing, this invention is further explained to a detail based on the example of an operation gestalt of this invention. Drawing 1 is drawing to show the drive approach of the 1st operation gestalt of this invention, and this drawing (a) is a timing diagram which shows the configuration of the time amount allocation for every scanning line. An axis of abscissa is a time-axis and an axis of ordinate is a scanning-

line shaft. This drawing shows the example of the eight scanning lines. Moreover, this drawing (b) is the timing diagram which shows the scanning-line electrical potential difference in the scanning line of No. 1 (1 Motome) in (a), and its transmission, and this drawing (c) is a timing diagram which shows the scanning-line electrical potential difference and transmission in the scanning line of No. 8 (last).

[0024] In this example of an operation gestalt, in the write-in period 101, after choosing each scanning line one by one and writing in data, it displays by shifting to the display period 102, and each scanning lines are succeedingly reset all at once in the reset period 103. Here, the sequence which scans the scanning line differs in the 1st field and the 2nd field in one frame. That is, in the 1st field, from the scanning line of No. 1 to the scanning line of No. 8, it scans one by one toward the bottom from a top, and scans from the bottom toward a top from the scanning line of No. 8 to the scanning line of No. 1 in the 2nd field. In addition, it is good even if respectively reverse in the scan sequence of the 1st field and the 2nd field.

[0025] As shown in drawing 1 (b), in the scanning line of No. 1, the scan signal for writing is impressed in early stages of the 1st field, and the scan signal for reset is impressed at the time of the field termination. Moreover, in the 2nd field, the scan signal for writing is conversely impressed to the last stage, and the scan signal for reset is impressed at the time of termination of the field. On the other hand, as shown in drawing 1 (c), in the scanning line of No. 8, the scan signal for writing is impressed to the last stage of the 1st field, and the scan signal for reset is impressed at the time of termination of the field. Moreover, in the 2nd field, the scan signal for writing is conversely impressed to the first stage, and the scan signal for reset is impressed at the time of termination of the field. In addition, in the example shown in drawing 1 (b) and (c), although the write-in signal is made into the signal of a white display (high permeability) and being considered as the signal of a black display (low permeability) at the time of reset, the permeability at the time of writing itself differs according to actual write-in data.

[0026] With the scanning line of No. 1, permeability begins to rise from the early stages of the 1st field, the maximum permeability is reached after write-in termination, and it becomes the minimum permeability in the reset period at the time of field termination. Moreover, in the 2nd field, permeability begins to rise conversely in the last stage, the maximum permeability is reached after write-in termination, and it becomes the minimum permeability in the reset period just behind that. On the other hand, with the scanning line of No. 8, permeability begins to rise from the last stage of the 1st field, the maximum permeability is reached after write-in termination, and it becomes the minimum permeability in the reset period just behind that. Moreover, in the 2nd field, permeability begins to rise the first stage conversely, the maximum permeability is reached after write-in termination, and it becomes the minimum permeability in the reset period at the time of field termination.

[0027] Drawing 2 (a) is a brightness distribution map within a field between each ** of the liquid crystal display panel in the example shown in drawing 1 , when the same sign shows Screens 1A, 1B, and 1C in drawing 1 (a), they correspond, respectively, and it shows each luminance distribution at the time of the write-in anaphase and the 1st field last stage at the time in early stages of [write-in] the 1st field. Moreover, when the same sign shows Screens 1D, 1E, and 1F in drawing 1 (a), they correspond, respectively, and each luminance distribution at the time of the write-in anaphase and the 2nd field last stage is shown at the time in early stages of [write-in] the 2nd field. Drawing 2 (b) is the luminance distribution actually observed, i.e., the luminance distribution by which the time average was carried out over frame time. As shown in drawing 2 (a), it corresponds to permeability change of drawing 1 (c), and the panel upper part becomes brighter than the lower part, and the panel lower part becomes brighter than the upper part by 1D and 1E of the 2nd field at 1A and 1B of the 1st field. Moreover, in the field last stages 1C and 1F, the 1st and 2nd fields serve as a black display. Thus, between each **, although the luminance distribution within a field is large, the difference in the luminance distribution within a field is equalized and the brightness within a field observed is uniform so that he can understand these brightness by drawing 2 (b) which carried out the time average.

[0028] Drawing 3 (a) - (c) is a timing diagram which shows the 2nd example of an operation gestalt of this invention with the same method of presentation as drawing 1 (a) - (c), respectively. Although the bidirectional scan is performed like the 1st example of an operation gestalt in this example of an operation gestalt, in that arrangement of a reset period differs, and performing the interlace drive, it differs from the 1st example of an operation gestalt. In this example of an operation gestalt, the moiety (No. odd) of Uchi of all the eight scanning lines is scanned in the 1st field (selection), and the remaining moieties (No. even) are scanned in the 2nd field. The reset period 103 in each scanning line is arranged at the time of termination of the field of the not scanning (selection). That is, the scanning line of No. odd has the write-in period 101 all over the 1st field, it scans one by one from a top, writing is performed, the display period 102 continues after that, and the reset period 103 is established at the time of termination of the 2nd field. On the other hand, the reset period 103 is established at the time of the 1st field termination, the scanning line of No. even has the write-in period 101 all over the 2nd field, it scans one by one from the bottom, writing is performed, the display period 102 continues after that, and the next reset period is established at the time of the 1st field termination of the following frame (not shown).

[0029] In the 1st field, the odd-numbered scanning line is scanned one by one from a top from a top, and the even-numbered scanning line is scanned one by one from the bottom from a top in the 2nd field. That is, in the scanning line of No. 1, the scan signal for writing is impressed in early stages of the 1st field, and the scan signal for reset is impressed at the time of termination of the 2nd field. For this reason, permeability begins to rise from the early stages of the 1st field, the maximum permeability is reached after write-in termination, and it becomes the minimum permeability in the reset period at the time of termination of the 2nd field. On the other hand, in the scanning line of No. 8, the scan signal for reset is impressed at the time of termination of the 1st field, and the scan signal for writing is impressed to it in early stages of the 2nd field. For this reason, it becomes the minimum permeability at the time of termination of the 1st field, permeability begins to rise in early stages of the 2nd field, and the maximum permeability is reached after write-in termination.

[0030] Drawing 4 (a) and (b) indicate similarly the luminance distribution of the 2nd example of an operation gestalt to be drawing 2 (a) and (b), respectively. Screens 2A-2F in this drawing (a) correspond at each [which is shown with the same sign in drawing 3 (a)] time. As shown in drawing 4 (a), it corresponds to permeability change of drawing 3 (c), and the scanning line of No. even is always bright in an anaphase the early stages of writing, and write-in, and the scanning line of No. odd is brighter than the lower part in the panel upper part in the 1st field. On the other hand, the scanning line of No. odd is always bright in an anaphase the early stages of writing, and write-in, and the scanning line of No. even has the panel lower part brighter than the upper part in the 2nd field. Moreover, in the field last stage, the scanning line of No. even becomes black, as for the 1st field, the scanning line of No. odd becomes white, the scanning line of No. odd becomes black and, as for the 2nd field, the even-numbered scanning line becomes white. Thus, between each **, although the luminance distribution within a field is large, the difference in the luminance distribution within a field is greatly eased so that he can understand this property by drawing 4 (b) which carried out the time average. Here, although the stripes of light and darkness arise in the panel upper part and the lower part corresponding to the scanning line, in the panel center section, these stripes do not have **********. On an actual screen, since the pitch of the scanning line is fine, the stripes of this light and darkness are averaged spatially, and an almost uniform display is obtained over a face of panel.

[0031] In the 2nd example of an operation gestalt, it has the advantage that brightness is very high compared with the brightness of drawing 2 (b) of the 1st operation gestalt. Furthermore, since a flicker is generated for every Rhine of the odd number of an interlace drive, and even number, the flicker observed decreases by the equalization between Rhine. Moreover, the point that the period when a full screen becomes a black display does not exist at all also has effectiveness in reduction of a flicker.

[0032] Drawing 5 (a) - (c) is a timing diagram which shows the 3rd example of an operation gestalt of this invention with the same method of presentation as drawing 1 (a) - (c), respectively. With this operation gestalt, the bidirectional scan is performed by the interlace drive like the 2nd example of an operation gestalt, and it is equivalent to the drive approach which doubled the frame frequency of the 2nd example of an operation gestalt. That is, as shown in this drawing (a), the scanning line of No. odd has the write-in period 101 during the first half of the 1st field, it scans one by one from a top, writing is performed, the display period 102 continues after that, and the reset period 103 is established at the time of termination of the field. Time amount allocation also of the 2nd field is carried out similarly. On the other hand, the reset period 103 is established at the time of first half termination of the 1st field, the scanning line of No. even has the write-in period 101 in the second half of the field, a scan is performed one by one from the bottom, and the display period 102 continues after that. Time amount allocation also of the 2nd field is carried out similarly, and a reset period is established after that at the time of first half termination of the 1st field of the following frame (not shown).

[0033] As the scanning line of No. 1 is shown in drawing 5 (b), the scan signal for reset is impressed in early stages of the 1st field for the scan signal for writing, and the scan signal for reset is impressed for the scan signal for writing in early stages of the 2nd field, respectively at the time of the 2nd field termination at the time of the 1st field termination. By this, permeability begins to rise from the early stages of the 1st field, the maximum permeability is reached after write-in termination, and it becomes the minimum permeability in the reset period at the time of termination of the 1st field, and permeability begins to rise from the early stages of the 2nd field, the maximum permeability is reached after write-in termination, and it becomes the minimum permeability in the reset period at the time of termination of the 2nd field. On the other hand, as the scanning line of No. 8 is shown in drawing 5 (c), at the time of the termination in the first half of the 1st field, the scan signal for writing is impressed to the first stage in the second half of the 1st field for the scan signal for reset, and the scan signal for writing is impressed for the scan signal for reset to the first stage in the second half of the 2nd field, respectively at the time of the termination in the first half of the 2nd field. By this, it becomes the minimum permeability at the time of the termination in the first half of the 1st field, and permeability begins to rise in early stages in the second half of the 1st field, the maximum permeability is reached after write-in termination, it becomes the minimum permeability at the time of the termination in the first half of the 2nd field, permeability begins to rise in early stages in the second half of the 2nd field, and the maximum permeability is reached

after write-in termination.

[0034] Drawing 8 (a) is luminance distribution which is actually observed in the example of an operation gestalt of the above 3rd and by which the time average was carried out over frame time. The luminance distribution within the field seen by the conventional drive approach of drawing 15 (b) is eased. In this example of an operation gestalt, since the reset period of 2 times is prepared in 1 inter-frame, the brightness as the example of an operation gestalt of ** a 2nd is not obtained. Although the other descriptions are the same as that of the 2nd example of an operation gestalt, electric asymmetry differs greatly. In the writing of the 1st operation gestalt of drawing 1 , the die length of the display period 102 of the 1st field and the 2nd field differs in many cases. This tends to produce the electric asymmetry of the anti-electric-field reason which polarization generates in the case of the liquid crystal which has spontaneous polarization like a ferroelectric liquid crystal or antiferroelectricity liquid crystal, and becomes causes, such as seizure of an ion reason. Moreover, in the writing of the 2nd example of an operation gestalt of drawing 3 , since there is only one writing into one frame, the electric asymmetry according to the polarity of a data signal arises. On the other hand, since the die length of the display period 102 of the 1st field and the 2nd field is the same and both polar data signals can be written in in this example of an operation gestalt corresponding to each field, there is no electric asymmetry and it does not have generating of printing.

[0035] Drawing 6 (a) - (c) is a timing diagram which indicates the 4th example of an operation gestalt similarly to be drawing 1 (a) - (c), respectively. In this example of an operation gestalt, an interlace drive is carried out in the field of what is an interlace drive like the 2nd and 3rd examples of an operation gestalt, and is performing the bidirectional scan, and the fields differ from the example of an operation gestalt of these points in the point used as the relation of a bidirectional scan. That is, the scanning line of No. odd has the write-in period 101 during the first half of the 1st field, it scans one by one from a top, the display period 102 continues after that, and the reset period 103 is established at the time of the 1st field termination. Subsequently, the write-in period 101 is during the first half of the 2nd field, it scans one by one from the bottom, the display period 102 continues after that, and the reset period 103 is established at the time of the 2nd field termination. On the other hand, the reset period 103 is established at the time of first half termination of the 1st field, the scanning line of No. even has the write-in period 101 during the second half of the field, it is scanned one by one from a top, and the display period 102 continues after that. Then, the reset period 103 is established at the time of first half termination of the 2nd field, the write-in period 101 is during the second half of the field, it is scanned one by one from the bottom, the display period 102 continues after that, and a reset period is established at the time of first half termination of the 1st field of the following frame (not shown).

[0036] In the scanning line of No. 1, as shown in drawing 6 (b), the scan signal for reset is impressed in early stages of the 1st field for the scan signal for writing, and the scan signal for reset is impressed for the scan signal for writing in the last stage of the 2nd field, respectively at the time of the 2nd field termination at the time of the 1st field termination. By this, permeability begins to rise from the early stages of the 1st field, the maximum permeability is reached after write-in termination, and it becomes the minimum permeability in the reset period at the time of termination of the 1st field, and permeability begins to rise from the last stage in the first half of the 2nd field, the maximum permeability is reached after write-in termination, and it becomes the minimum permeability in the reset period at the time of termination of the 2nd field. On the other hand, in the scanning line of No. 8, as shown in drawing 6 (c), at the time of the termination in the first half of the 1st field, the scan signal for writing is impressed to the last stage in the second half of the 1st field for the scan signal for reset, and the scan signal for writing is impressed for the scan signal for reset to the first stage in the second half of the 2nd field, respectively at the time of the termination in the first half of the 2nd field. Thereby, as shown in drawing 6 (c), it becomes the minimum permeability at the time of the termination in the first half of the 1st field, permeability begins to rise in the second half of the 1st field in the last stage, the maximum permeability is reached after write-in termination, it becomes the minimum permeability at the time of the termination in the first half of the 2nd field, permeability begins to rise in early stages in the second half of the 2nd field, and the maximum permeability is reached after write-in termination.

[0037] Drawing 8 (b) shows the luminance distribution which is actually observed in this example of an operation gestalt and by which the time average was carried out over frame time. In this example of an operation gestalt, the luminance distribution within the field seen in the conventional drive approach of drawing 15 (b) or the 3rd example of an operation gestalt of drawing 8 (a) is lost. Consequently, the stripes of the light and darkness seen in the 2nd and 3rd examples of an operation gestalt do not occur. Moreover, since a flicker is generated for every Rhine of the odd number and even number of an interlace drive unlike the 1st operation gestalt of drawing 2 (b) which does not have luminance distribution into a field similarly, the flicker observed decreases by the equalization between Rhine. Moreover, the point that the period when a full screen becomes a black display does not exist at all also has effectiveness in reduction of a flicker. Furthermore, since the substantial frequency is high, while the difference of the die length of the display period of the 1st field and the 2nd field becomes one half extent as compared with the 1st example of an operation gestalt as compared with the 1st example of an operation gestalt of drawing 1 , two writing is possible within one

frame. Consequently, there are few differences of the die length of the display period 102 of the 1st field and the 2nd field, and since both polar data signals can be written in corresponding to each field, it is hard to be generated and electric asymmetry has little generating of printing.

[0038] Drawing 7 (a) - (c) is a timing diagram which indicates similarly the 5th example of an operation gestalt of this invention to be drawing 1 (a) - (c), respectively. this example of an operation gestalt -- the 2- an interlace drive is carried out in the field of what is performing the bidirectional scan by the interlace drive like the 4th example of an operation gestalt, and a bidirectional scan is performed, and the fields serve as relation of a bidirectional scan. That is, the scanning line of No. odd has the write-in period 101 during the first half of the 1st field, it scans one by one from a top, the display period 102 continues after that, and the reset period 103 is established at the time of field termination. Subsequently, the write-in period 101 is during the first half of the 2nd field, it scans one by one from the bottom, the display period 102 continues after that, and the reset period 103 is established at the time of field termination. On the other hand, the reset period 103 is established at the time of first half termination of the 1st field, the scanning line of No. even has the write-in period 101 during the second half of the field, it is scanned one by one from the bottom, and the display period 102 continues after that. Subsequently, the reset period 103 is established at the time of first half termination of the 2nd field, the write-in period 101 is during the second half of the field, it is scanned one by one from a top, the display period 102 continues after that, and a reset period is established at the time of first half termination of the 1st field of the following frame (not shown).

[0039] In the scanning line of No. 1, as shown in drawing 7 (b), the scan signal for reset is impressed in early stages of the 1st field for the scan signal for writing, and the scan signal for reset is impressed for the scan signal for writing in the last stage of the 2nd field, respectively at the time of the 2nd field termination at the time of the 1st field termination. By this, permeability begins to rise from the early stages of the 1st field, the maximum permeability is reached after write-in termination, and it becomes the minimum permeability in the reset period at the time of termination of the 1st field, and permeability begins to rise from the last stage in the first half of the 2nd field, the maximum permeability is reached after write-in termination, and it becomes the minimum permeability in the reset period at the time of termination of the 2nd field. On the other hand, in the scanning line of No. 8, as shown in drawing 7 (c), at the time of the termination in the first half of the 1st field, the scan signal for writing is impressed to the first stage in the second half of the 1st field for the scan signal for reset, and the scan signal for writing is impressed for the scan signal for reset in the last stage in the second half of the 2nd field, respectively at the time of the termination in the first half of the 2nd field. By this, it becomes the minimum permeability at the time of the termination in the first half of the 1st field, and permeability begins to rise in early stages in the second half of the 1st field, the maximum permeability is reached after write-in termination, it becomes the minimum permeability at the time of the termination in the first half of the 2nd field, permeability begins to rise in the second half of the 2nd field in the last stage, and the maximum permeability is reached after write-in termination. The brightness distribution map within the panel side by which the time average was carried out over frame time actually observed with the operation gestalt from a book is the same as that of drawing 8 (b) which shows the 4th operation gestalt. The other descriptions are the same as that of the 4th example of an operation gestalt.

[0040] Drawing 9 (a) is a timing diagram which indicates similarly the 6th example of an operation gestalt of this invention to be drawing 1 (a). this example of an operation gestalt -- the 2- it is the scan timing when using the data signal electrical potential difference shown by drawing 17 of what currently is performing the bidirectional scan by the interlace drive like the 5th example of an operation gestalt, and differs from the previous example of an operation gestalt in the point that 2 times of the write-in periods 101 and 1 time of the reset period 103 exist in one frame. That is, the scanning line of No. odd has the write-in period 101 during the first half of the 1st field, it scans one by one from a top, and the display period 102 continues after that. Subsequently, the write-in period 101 is during the first half of the 2nd field, it scans one by one from a top, the display period 102 continues after that, and the reset period 103 is established at the time of field termination. On the other hand, the reset period 103 is established in the middle of the 1st field, the scanning line of No. even has the write-in period 101 during the second half of the field, it is scanned one by one from the bottom, and the display period 102 continues after that. Subsequently, the write-in period 101 is during the field second half of the 2nd field, it is scanned one by one from the bottom, the display period 102 continues after that, and a reset period is established in the middle of the 1st field of the following frame (not shown).

[0041] Drawing 9 (b) is luminance distribution which is actually observed in this example of an operation gestalt and by which the time average was carried out over frame time. Although the luminance distribution within the field seen by the conventional drive approach of drawing 15 (b) is eased, in the panel upper part and the lower part, the stripes of light and darkness arise corresponding to the scanning line. In the panel center section, these stripes are hardly produced. When the pitch of the scanning line is fine, the stripes of this light and darkness are averaged spatially, and an almost uniform display is obtained over the whole panel surface. Moreover, compared with conventional drawing 15 (b) and drawing 2 (b) of the 1st operation gestalt, brightness is very high. Furthermore, since the time amount from a

reset period to the next write-in period is short compared with the 2nd operation gestalt, high brightness is obtained. Furthermore, since it generates for every Rhine of the odd number and even number of an interlace drive, the flicker observed reduces a flicker by the equalization between Rhine. Moreover, the point that the period when a full screen becomes a black display does not exist also has effectiveness in reduction of a flicker.

[0042] Drawing 9 (c) is a timing diagram which indicates similarly the 7th example of an operation gestalt of this invention to be drawing 1 (a). although this example of an operation gestalt is the same as the 6th example of an operation gestalt almost -- the scanning direction of the 2nd field -- differing -- the 2- the same interlace drive as the 5th operation gestalt -- and the bidirectional scan is performed. That is, the scanning line of No. odd has the write-in period 101 during the first half of the 1st field, it scans one by one from a top, and the display period 102 continues after that. Subsequently, the write-in period 101 is during the first half of the 2nd field, it scans one by one from the bottom, the display period 102 continues after that, and the reset period 103 is established at the time of field termination. On the other hand, the reset period 103 is established in the middle of the 1st field, the scanning line of No. even has the write-in period 101 during the second half of the field, it is scanned one by one from the bottom, and the display period 102 continues after that. Then, the write-in period 101 is during the field second half of the 2nd field, it is scanned one by one from a top, the display period 102 continues after that, and a reset period is established in the middle of the 1st field of the following frame (not shown). The luminance distribution of the panel by which the time average was carried out is the same as that of drawing 9 (b) of the 9th example of an operation gestalt.

[0043] Drawing 10 (a) is a timing diagram which shows the 8th example of an operation gestalt of this invention. In this example of an operation gestalt, it is premised on performing a field sequential display, and, in addition to the timing diagram of drawing 1 (a), the brightness which carries out incidence to the panel of the light source as one of the axes of ordinate is shown. The light source is scanned in order of red, green, and blue in this drawing. In addition, this sequence can be changed to arbitration corresponding to exchange of a data signal. The light source does not carry out incidence of during the reset period of the scanning line to a panel side, and this period turns into a period changed to other colors. Although it is the same as that of the scan timing when using the data signal electrical potential difference of drawing 17 about a scan, since it is a field sequential display, 3 times of the reset periods 103 exist in one frame. During the scan of each color, 2 times of the write-in periods 101 are established, and the data signal of positive/negative is distributed and impressed to each write-in period for every sign. The reset period 103 prepares after two writing, and it is ****. The group which consists of this two writing and one reset is repeated 3 times synchronizing with each color. It is possible for the information on each color to be displayed into one frame, and to perform color display per 1 pixel as a result of the scan of these light sources and the scanning line. Since the count of a reset period is one half compared with the case where a field sequential display is performed by repeating the drive approach of conventional drawing 14 3 times, the high display of brightness is possible. In addition, the luminance distribution within a panel side observed serves as a display with a dark bottom of screen like drawing 15 (b).

[0044] Drawing 10 (b) is a timing diagram which indicates similarly the 9th example of an operation gestalt of this invention to be drawing 10 (a). The light source is scanned in order of red, green, and blue like the 8th operation gestalt. In addition, this sequence can be changed to arbitration corresponding to exchange of a data signal. This example of an operation gestalt differs from the 8th example of an operation gestalt in the point that the light source is made into the period which does not carry out incidence of during a period until a display 1st during a write-in period is stabilized not only after during the reset period of the scanning line but after reset to a panel side, and is changed to other colors. That is, after the shift to a new display condition from a reset condition is completed from the panel upper part to the lower part, incidence of the light of the light source is carried out to a panel, and it is recognized by the observer. By this approach, the luminance distribution within a panel side seen with the 8th operation gestalt is lost, and uniform brightness is obtained by the full screen. Drawing 18 is a timing diagram which shows time amount allocation of the brightness of the light source of the gestalt for abolishing the luminance distribution within a panel side by the conventional field sequential display, the configuration of the time amount allocation for every scanning line, and actuation. After reset finishes and a write-in display is stabilized conventionally, the time amount which carries out incidence of the light from the light source to a panel, and makes the light source turn on is very short. On the other hand, since light source lighting time amount can secure for a long time in this example of an operation gestalt, the brightness of the whole panel is high.

[0045] Drawing 11 is a timing diagram which indicates similarly the 10th example of an operation gestalt of this invention to be drawing 9 (a). The light source is scanned in order of red, green, and blue. In addition, this sequence can be changed to arbitration corresponding to exchange of a data signal. About a scan, although it is the same as that of the scan timing of a bidirectional scan of the 1st operation gestalt of drawing 1 , since it is a field sequential display, 3 times of the reset periods 103 exist in one frame. During the scan of each color, 2 times of the write-in periods 101 are established, and the data signal of positive/negative is distributed and impressed to each write-in period for every sign. Each write-in period 101 corresponds to the bidirectional scan of the scan from a top, and the scan from the

bottom. In drawing 11 , when the light source is red, for example, the scan from a top is performed and, subsequently the group which consists of two writing and two reset is repeated 3 times like a reset period, the scan from the bottom, and a reset period synchronizing with each color. Here, one writing and one reset will be called a subfield. The 1st subfield and 2nd subfield exist to each color, this group is repeated 3 times by making these into a group, and one frame is constituted. The light is switched on with the beginning of the 1st subfield, the light source is switched off just before the reset period of the 2nd subfield, and a change in other colors is performed during a reset period. It is possible for the information on each color to be displayed into one frame, and to perform color display per 1 pixel as a result of the scan of these light sources and the scanning line. It is not necessary to adjust the lighting time amount of the light source like the 9th example of an operation gestalt, and there is no luminance distribution in a panel side for the same bidirectional scan as the 1st operation gestalt. Moreover, since the light source lighting period is longer than the conventional approach of drawing 18 , brightness is high. Furthermore, although it is necessary to turn the light source on and off for every subfield in drawing 18 , the need does not exist with this operation gestalt.

[0046] The 11th example of an operation gestalt of this invention is the liquid crystal display which used either of the drive approaches of the 1st to 7th example of an operation gestalt. Drawing 12 is the top view in which showing the liquid crystal display of this example of an operation gestalt, and showing the TFT (thin film transistor) array on one substrate. The substrate of this example of an operation gestalt consists of a TFT substrate and an opposite substrate, and as shown in drawing 12 , a TFT substrate has two or more gate bus lines 3, two or more drain bus lines 1, and the array that consists of two or more TFT1, and has at least one pixel electrode 4 in each pixel. Drawing 13 is the mimetic diagram showing the cross section of the liquid crystal display of this example of an operation gestalt. An electrode 7 is formed on each of two support substrates 6, and the orientation film 8 to which orientation of the liquid crystal is carried out is formed on it. Between the support substrates 6 of this pair, liquid crystal 9 is pinched and the polarizing plate 5 of a pair is formed outside.

[0047] The actuation of this operation gestalt is as follows. The signal data wave corresponding to each drive approach is impressed to each drain bus line 1 with predetermined frequency corresponding to each gate line 3. On the other hand, when the Rhine is chosen as each gate bus line 3, the wave shown in each example of an operation gestalt which turns on the switch of TFT2 is impressed to it, and thereby, the wave of the drain line 1 is impressed to liquid crystal with a display electrode. An electrical potential difference is held at the liquid crystal section until the gate line 3 is chosen again. Even if liquid crystal does not have memory nature by this, maintenance actuation of a display is possible. A wave which reset impresses the predetermined signal data for reset to the drain line 1, and turns on the switch of TFT1 is impressed to the timing shown with each operation gestalt. Thereby, the liquid crystal display which applied one drive approach of the 1st to 7th example of an operation gestalt of this invention is realized.

[0048] The 12th example of an operation gestalt of this invention has the same structure with having been shown in drawing 13 , and is a liquid crystal display using either of the drive approaches of the 8th to 10th example of an operation gestalt. An electrode 7 is formed on each of two support substrates 6, and the orientation film 8 to which orientation of the liquid crystal 9 is carried out is formed on it. Between the support substrates of this pair, liquid crystal 9 is pinched and the polarizing plate 5 of a pair is formed outside. Furthermore, one polarizing plate 5 side is equipped with the light source which is not illustrated for a field sequential display. The liquid crystal display which applied one drive approach of the 8th to 10th example of an operation gestalt is realized by this configuration.

[0049] In the liquid crystal display of the 11th and 12th examples of an operation gestalt, offset or the configuration eased on the whole is used for the 13th example of an operation gestalt of this invention for the luminance distribution within a panel side by the viewing-angle dependency and the drive approach which liquid crystal display mode has. Luminance distribution within panel side ** which originates in the viewing-angle dependency which liquid crystal display mode has, and the drive approach by this configuration is eased, and the liquid crystal display of a very good display is realized.

[0050] Hereafter, the example of a concrete configuration of the liquid crystal display which actually applied the above-mentioned example of an operation gestalt of this invention is shown as each example.

[0051] The 1st example: Using the chromium (Cr) formed in 480 gate bus lines and 640 drain bus lines by the spatter, line breadth was set to 10 micrometers and silicon nitride (SiNx) was used for gate dielectric film. Magnitude of a 1 unit pixel was set to 330 micrometers long and 110 micrometers wide, TFT (thin film transistor) was formed using the amorphous silicon, and the pixel electrode was formed by the spatter using the indium oxide tin (ITO) which is a transparent electrode. Thus, the glass substrate which formed TFT in the shape of an array was used as the 1st substrate. After forming the light-shielding film which used chromium, the protective layer which formed the transparent electrode (common electrode) which used ITO, formed the color filter in the shape of a matrix by the staining technique further, and used the silica for that top face was prepared in this 1st substrate and the 2nd substrate which counters. Then, fusibility polyimide was printed by print processes, it baked at 180 degrees C, and the solvent was removed. The buff cloth which used rayon for this polyimide film top was twisted around the roller with a

diameter of 50mm, and rubbing was carried out in the direction which serves as parallel rubbing by engine-speed 600rpm of a roller, the stage passing speed of 40mm/second, the amount of pushing of 0.7mm, and two counts of rubbing. The thickness of the orientation film measured with the contact level difference plan was about 500A, and the pre tilt angle measured by the crystal rotation method was 7 times. The sealant of ultraviolet-rays hardenability which true **** (micro pearl) which is the spherical spacer of the diameter of about 9.5 micrometer was sprinkled [sealant] to one side of the glass substrate of such a pair, and made another side distribute the glass rod spacer of the shape of a cylinder of the diameter of about 9.5 micrometer was applied. The sealant was stiffened by the processing which both substrates are made to counter, arranges and irradiates ultraviolet rays by non-contact so that the rubbing processing direction may serve as parallel rubbing mutually in these substrates, and the gap 9.5micrometer panel was assembled. The nematic liquid crystal was poured into this panel. In this example, the compensating plate was added so that it might become the OCB (OPUTIKARI KOMPENSEITIDDO BAIRIFURIJIENSU) display mode shown in 930 pages from 927 pages of S eye dee 94 and a digest. Thus, the driver for a drive was attached in the produced liquid crystal panel, and it considered as the liquid crystal display.

[0052] The drive approach of the 1st operation gestalt was applied with this liquid crystal display. The reset period 103 was made into 5 mses, made the write time of each scanning line 15 microseconds, and, specifically, made 1 field period 16.7 mses. Consequently, the display period of 4.5 ms extent was secured in 1 field also with the scanning line scanned at the end in order of a scan. Addition of the both sides of a bidirectional scan acquired the display period of 16 ms extent in one frame. Moreover, although the speed of response at the time of the standup of this liquid crystal is based also on applied voltage, it is 5 ms extent from several mm, and a response ends it after write-in termination. As liquid crystal display mode, a viewing-angle dependency is hardly extremely seen on a wide-field-of-view square. the place which observed this liquid crystal display, and ** by which the luminance distribution in the panel side by drive was not observed -- extensive -- the description in angle of visibility liquid crystal display mode was employed efficiently -- extensive -- the angle of visibility display was obtained.

[0053] The 2nd example: The TFT substrate and the color filter substrate were produced like the 1st example. Then, polyamic acid was applied with the spin coat method, it baked and imide-ized at 200 degrees C, and the polyimide film was formed. The buff cloth which used nylon for this polyimide film was twisted around the roller with a diameter of 50mm, and rubbing was carried out in the direction which serves as 10-degree cross rubbing by engine-speed 600rpm of a roller, the stage passing speed of 40mm/second, the amount of pushing of 0.7mm, and two counts of rubbing. The thickness of the orientation film measured with the contact level difference plan was about 500A, and the pre tilt angle measured by the crystal rotation method was 1.5 degrees. The thermosetting sealant which true **** (micro pearl) which is the spherical spacer of the diameter of about 2 micrometer was sprinkled [sealant] to one side of the glass substrate of such a pair, and made another side distribute the glass rod spacer of the shape of a cylinder of the diameter of about 2 micrometer was applied. Both substrates were made to counter, it has arranged, the sealant was stiffened by heat treatment, and the gap 2micrometer panel was assembled so that the rubbing processing direction might serve as 10-degree cross rubbing mutually in these substrates. The antiferroelectricity liquid crystal constituent which carries out V character mold switching shown from 61 pages of the Asia display 95 at 64 pages to this panel was poured in in the state of the 85-degree C isotropic phase (Iso) into the vacuum. While the amplitude impressed the square wave which is **10V by 3kHz and the frequency impressed electric field all over the panel using an arbitration waveform generator and high power amplifier with 85 degrees C, it cooled slowly at the rate of 0.1 degrees C / min to the room temperature. Thus, the driver for a drive was attached in the produced liquid crystal panel, and it considered as the liquid crystal display.

[0054] The drive approach of the 5th operation gestalt was applied with this liquid crystal display. The reset period 103 was made into 1 ms, made the write time of each scanning line 10 microseconds, and 1 field period was made into 16.7 mses, and, specifically, it made the one-frame period 33.4 mses. Consequently, the display period of ten or more mses was secured in 1 field also with the scanning line scanned at the end in order of a scan. Addition of the both sides of a bidirectional scan acquired the display period of 25 mses in one frame. Moreover, although the speed of response at the time of the standup of this liquid crystal is based also on applied voltage, it is about hundreds of microseconds and a response ends it after write-in termination. As liquid crystal display mode, a viewing-angle dependency is hardly extremely seen on a wide-field-of-view square. the place which observed this liquid crystal display, and ** without the luminance distribution in the panel side by drive -- extensive -- the description in angle of visibility liquid crystal display mode was employed efficiently -- extensive -- the angle of visibility display was obtained.

[0055] The 3rd example: The configuration of a liquid crystal panel presupposed that it is the same as the 2nd example. It considered as the field sequential liquid crystal display at this liquid crystal panel using the driver for a drive, and the back light in which high-speed switching is possible.

[0056] With this liquid crystal display, the scan of the drive approach and the brightness of the light source was based on the 10th operation gestalt. The reset period 103 was made into 1 ms, made the write time of each scanning line 5

microseconds, and, specifically, made the one-frame period 33.4 mses. Consequently, the time amount of 6.5 or more mses was acquired at the display period over each color. Moreover, there was no luminance distribution within a panel side.

[0057] The field sequential liquid crystal display which used the same liquid crystal display mode as the 3rd example as an example of a comparison, and used the scan of the drive approach of drawing 18 and the brightness of the light source was used. Although there was no luminance distribution within a panel side as well as the 3rd example, the display period over each color was 4 ms extent, and panel brightness was one half extent of this example of an operation gestalt.

[0058] The 4th example: The micro display was produced as a projector of a reflective mold. It produced like the micro display by the display tech shrine as shown in the beginning of a book of the January, 1997 issue of advanced imaging **. Specifically, DRAM was produced by forming MOS-FET on a silicon wafer in 0.8-micrometer Ruhr. Size etc. is 1/2 inch of die sizes, and formed about pixel pitch 10micrometer and the 1 megger DRAM. The numerical aperture of a pixel was 90% or more. Furthermore, flattening was carried out by giving a chemical mechanical polishing technique to the formed DRAM front face. On the other hand, the cover glass for microscope observation was used for the substrate which counters. The part which includes a drive circuit from a silicon wafer was started, the orientation film by fusibility polyimide was printed, it baked at 170 degrees C, and the solvent was removed. The buff cloth which used nylon for this polyimide film was twisted around the roller with a diameter of 50mm, and rubbing was carried out by engine-speed 600rpm of a roller, the stage passing speed of 40mm/second, the amount of pushing of 0.7mm, and two counts of rubbing. The thickness of the orientation film measured with the contact level difference plan was about 500A, and the pre tilt angle measured by the crystal rotation method was 1.5 degrees. Moreover, the sealant of the photoresist which distributed the glass rod spacer of the shape of a cylinder of the diameter of about 2 micrometer was applied. These substrates were made to counter and it has arranged, and by carrying out ultraviolet treatment by non-contact, the sealant was stiffened and the gap 2micrometer panel was assembled. The antiferroelectricity liquid crystal constituent which carries out V character mold switching shown from 61 pages of the Asia display 95 at 64 pages to this panel was poured in in the state of the 85-degree C isotropic phase (Iso) into the vacuum. While the amplitude impressed the square wave which is **10V by 3kHz and the frequency impressed electric field all over the panel using an arbitration waveform generator and high power amplifier with 85 degrees C, it cooled slowly at the rate of 0.1 degrees C / min to the room temperature. Furthermore, the reflective mold field sequential projector was produced using the collimate lens, the polarization sensing element, and the lens for projection for obtaining the light emitting diode and parallel light of three colors.

[0059] The drive approach of this liquid crystal display was based on the approach of the 9th example of an operation gestalt. As a result, the good display without the luminance distribution within a field was obtained.

[0060] The 5th example: The TFT substrate and the color filter substrate were produced like the 1st example. Then, fusibility polyimide was printed by print processes, it baked at 180 degrees C, and the solvent was removed. The buff cloth which used rayon for this polyimide film top was twisted around the roller with a diameter of 50mm, and rubbing was carried out in the direction which serves as rubbing 90 degrees by engine-speed 600rpm of a roller, the stage passing speed of 40mm/second, the amount of pushing of 0.7mm, and two counts of rubbing. The thickness of the orientation film measured with the contact level difference plan was about 500A, and the pre tilt angle measured by the crystal rotation method was 3 times. The sealant of ultraviolet-rays hardenability which true **** (micro pearl) which is the spherical spacer of the diameter of about 5.5 micrometer was sprinkled [sealant] to one side of the glass substrate of such a pair, and made another side distribute the glass rod spacer of the shape of a cylinder of the diameter of about 5.5 micrometer was applied. Both substrates were made to counter and it has arranged so that the rubbing processing direction may serve as rubbing 90 degrees mutually in these substrates, and the sealant was stiffened by the processing which irradiates ultraviolet rays by non-contact, and the gap 5.5micrometer panel was assembled. The nematic liquid crystal was poured into this panel. The TN liquid crystal display mode consisted of this examples. Thus, the driver for a drive was attached in the produced liquid crystal panel, and it considered as the liquid crystal display.

[0061] The drive approach of this example performed the conventional drive approach shown by drawing 14 . However, the direction of the viewing-angle dependency of the vertical direction which TN mold display mode has was adjusted, and from above, it became bright at the time of observation, and was made the location which becomes dark from down at the time of observation. Consequently, when a panel was observed from a transverse plane, the luminance distribution and the viewing-angle dependency within the panel side by the drive approach compensated and suited, and the good display was obtained from the conventional panel.

[0062] As mentioned above, although this invention was explained based on the suitable example of an operation gestalt, the liquid crystal drive approach and liquid crystal display of this invention are not limited only to the configuration of the above-mentioned example of an operation gestalt, and an example, and what performed various corrections and modification from the configuration of the above-mentioned example of an operation gestalt and an

example is contained in the range of this invention.

[0063]

[Effect of the Invention] According to this invention, even if it uses a reset pulse in the liquid crystal display of a high-speed response, there is little luminance distribution within a field, there are few flickers, it is high brightness by high contrast, and the drive approach without the electric effect of asymmetric can be realized. Moreover, according to this invention, the liquid crystal display which used those drive approaches, and a field sequential liquid crystal display are realizable.

[Translation done.]

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TECHNICAL FIELD

[Field of the Invention] This invention relates to the drive approach of a liquid crystal display, and a liquid crystal display.

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PRIOR ART

[Description of the Prior Art] The mainstream of a high performance liquid crystal display is the TFT (thin film transistor) method active-matrix liquid crystal display in TN (Twisted Nematic) mode in which current and a nematic liquid crystal are used, or IPS (the Inn plane switching) mode. In these active-matrix liquid crystal displays, in order that a picture signal may write in positive/negative by 30Hz, it is usually rewritten by 60Hz, and the time amount of the 1 field is about 16.7ms (ms). Here, the sum total time amount of both positive/negative is called one frame, and is about 33.3ms. On the other hand, the response time of the present liquid crystal is this frame time extent also in the quickest speed of response. For this reason, when displaying the video signal which consists of an animation, or in displaying a high-speed computer image, a speed of response quicker than current frame time is needed.

[0003] On the other hand, in order for a liquid crystal display to aim at the further highly minute-ization, the field sequential color liquid crystal display which changes the back light which is the illumination light of a liquid crystal display to red, green and blue, and a time amount target is examined. Since it is not necessary to arrange a color filter spatially by this method, 3 times [over the past] as many highly-minute-izing as this is possible. In a field sequential liquid crystal display, since it is necessary to display one color by one third of the time amount of the 1 field, the time amount which can be used for a display is set to about 5ms. Therefore, the liquid crystal itself is asked for the response time shorter than 5ms. Use of the liquid crystal which has spontaneous polarization like a ferroelectric liquid crystal or antiferroelectricity liquid crystal as liquid crystal which can realize such a high-speed response is considered. Moreover, also in the nematic liquid crystal, the improvement in the speed by thin-film-izing [which makes viscosity low], or changing liquid crystal orientation into the orientation of a pie mold etc. which enlarges a dielectric anisotropy is considered.

[0004] The time amount by which an electrical potential difference and a charge are actually written in the liquid crystal section with a active-matrix liquid crystal display component is only the selection time amount (write time) of each scanning line. This time amount is about 5 microseconds, when in the case of the liquid crystal display which has 1000 Rhine and is written in by 1 field time amount it is 16.7 microseconds (microsecond) and performs a field sequential drive. In the present condition, the use gestalt of a liquid crystal device or liquid crystal which a response ends in such time amount hardly exists. In the liquid crystal device which has above-mentioned spontaneous polarization, or the accelerated nematic liquid crystal, the component which carries out such a quick response is not known. Consequently, the following problems occur. That is, the response of liquid crystal will usually break out after write-in termination of a signal. Consequently, it is if the electrical potential difference of liquid crystal layer both ends falls rapidly in the liquid crystal which has spontaneous polarization since the anti-electric field by rotation of spontaneous polarization occur. For this reason, the electrical potential difference written in the both ends of a liquid crystal layer changes a lot. On the other hand, change occurs in the maintenance electrical potential difference which writes in a liquid crystal layer and should be held since capacity change of the liquid crystal layer according to the anisotropy of a dielectric constant also in a high-speed nematic liquid crystal becomes very large. It becomes insufficient writing in the fall of such a maintenance electrical potential difference, i.e., the fall of effective applied voltage, and it reduces the contrast of a screen.

[0005] When the same picture signal continues being written in over several frames from the frame from which the picture signal changed from PERT 1 of the 36th volume of Japanese applied physics, and No. 2 720 pages to 729 pages, and the absolute value of a signal level changed, the purport as which the phenomenon called a "step response" is regarded is indicated. To the same signal level, this phenomenon is a phenomenon in which permeability carries out vibration of light and darkness for every field over several frames, and is stabilized in the fixed amount of transmitted lights several frames after.

[0006] The example of the above-mentioned phenomenon is explained with reference to the mimetic diagram of drawing 16 . This drawing (a) is a wave form chart of a data electrical potential difference, and (b) is the wave form chart of the permeability at that time. If the data electrical potential difference of drawing 16 (a) is impressed to liquid

crystal, like drawing 16 (b), permeability carried out vibration of light and darkness for every field, and it has settled in fixed permeability at last by the 4th frame in the example shown here. Thus, since several frames are needed for an actual permeability change, the rapidity of a display image is lost.

[0007] The permeability after a liquid crystal response is decided not by the impressed signal level but by the amount of charges stored in the liquid crystal capacity after a liquid crystal response. This amount of charges is determined by the stored charge before signal writing, and the write-in charge written in newly. Moreover, the stored charge after this response changes also with pixel design values, such as a physical property value of liquid crystal, an electrical parameter, and storage capacitance. For this reason, in order to take correspondence of a signal level and permeability, the information for writing in with (1) signal level and calculating correspondence of a charge, stored charge before (2) writing, and stored charge after (3) responses, actual count, etc. are needed. Consequently, the count section of the frame memory for memorizing (2) over a full screen, (1), and (3) is needed. This causes increase of the number of components of a system, and is not desirable.

[0008] As an approach of solving the above-mentioned problem, the reset pulse method for impressing the reset electrical potential difference arranged with a predetermined liquid crystal condition is often used before new data writing. According to this reset pulse method, since it is surely in the predetermined condition at the time of the writing of new data, correspondence of 1 to 1 is seen between the written-in signal level and the permeability obtained. By this correspondence of 1 to 1, while the generating approach of the signal for a drive becomes simple, means, such as a frame memory which memorizes the last write-in information, become unnecessary.

[0009] The method of generating a forward and negative data signal electrical potential difference to a fixed picture signal as the another impression approach of a reset electrical potential difference, impressing a negative (forward) electrical potential difference, after impressing a forward (negative) electrical potential difference, and impressing a reset electrical potential difference after that is also used. In this case, if the data signal electrical potential difference of positive/negative with the equal amplitude is impressed simply, the above-mentioned "step response" will arise. Then, impression of a data signal electrical potential difference which has the wave shown in drawing 17 (a) is performed. Drawing 17 (b) is the wave form chart of the permeability then obtained. The wave shown in this drawing by the dotted line is a wave of the permeability when impressing the wave of the data electrical potential difference at the time of making the amplitude equal by positive/negative, and its wave.

[0010] In order to prevent a "step response", as shown in drawing 17 (a), the amplitude of the data electrical potential difference in the first half of a frame (here forward data electrical potential difference) is set up low, and the amplitude of the data electrical potential difference in the second half of a frame (here negative data electrical potential difference) is made to be the same as that of the wave of a dotted line. A step response is prevented by this, and as shown in this drawing (b), the first half of a frame and the permeability same in the second half are obtained. Liquid crystal is arranged with the condition that predetermined reset was made, by resetting at the time of next frame termination. With the following frame, correspondence of 1 to 1 called fixed permeability is obtained to a fixed signal level by newly impressing the same wave.

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EFFECT OF THE INVENTION

[Effect of the Invention] According to this invention, even if it uses a reset pulse in the liquid crystal display of a high-speed response, there is little luminance distribution within a field, there are few flickers, it is high brightness by high contrast, and the drive approach without the electric effect of asymmetric can be realized. Moreover, according to this invention, the liquid crystal display which used those drive approaches, and a field sequential liquid crystal display are realizable.

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TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention] the conventional reset pulse method -- the above -- even if it adopts which reset pulse method, the following problems exist. It is a problem from which brightness changes with the locations in a screen a lot first according to the timing which resets. For example, if it resets after [all] the Rhine scan termination when scanning one by one toward the lower part from the screen upper part, in the screen upper part, reset will be performed by the bottom of screen to the display time after the writing for the about 1 field being acquired, without writing in and acquiring only behind slight display time. This phenomenon is explained with reference to drawing 14 .

[0012] Drawing 14 (a) is drawing typically displayed by two-dimensional according the condition of each period of the write-in (scan) period 101, the display period 102, and the reset period 103 to the scanning direction and time-axis of a screen. It has the eight scanning lines, a scan is performed one by one from the screen upper part in the write-in period 101 in the lower part, it results after a fixed display period 102 at the reset period 103, and this drawing shows the purport by which a full screen is reset at once. Drawing 14 (b) shows typically the scanning-line electrical potential difference and permeability on the scanning line of the screen topmost part at the time of performing a white display using such a drive approach, i.e., No. 1, (1 Motome). Moreover, this drawing 14 (c) shows typically the scanning-line electrical potential difference and permeability on the screen bottom, i.e., the scanning line of No. 8 (8 Motome). Although a white display is obtained with the scanning line of No. 1 in the comparatively long period excluding the reset period and the standup period of a response from the one-frame period, since reset starts in response termination and coincidence, a white display is hardly obtained with the scanning line of No. 8. Consequently, if it sees in the whole frame period as shown in drawing 15 (b) when the same signal is displayed, the phenomenon in which it is bright in the screen upper part, and a bottom of screen is dark will occur. Such field internal division cloth reduces image quality remarkably.

[0013] Next, since the period changed into a predetermined display condition always exists, there are the whole contrast and a problem that the maximum permeability decreases. For example, when changing into the condition of a black display by reset, the period when predetermined displays other than a black display are obtained decreases compared with the case where it does not reset, and the maximum permeability and the permeability of each gradation decrease. On the other hand, since the permeability at the time of reset is added at the time of a black display and it is averaged in time when changing into conditions other than a black display by reset, the permeability of a black display rises and contrast falls.

[0014] Moreover, since the period which becomes fixed permeability always exists, there is a problem that a flicker occurs between the permeability and other display permeability. For example, since a full screen flickers to coincidence in resetting the whole screen surface to coincidence, a flicker is recognized violently.

[0015] Furthermore, there is a problem that a scan period becomes short by the reset period. Usually, a scan period (write time) is almost equal to what divided the field time amount which is the time amount of the one half of frame time by the scanning-line number. However, if a reset period is established into field time amount, the scan period 101 shown in drawing 14 (a) will become what divided what lengthened the reset time 103 by the scanning-line number (8) from field time amount. Consequently, a scan period becomes short. As a means for a reset period to solve the problem which affects a scan period, the technique of combining an interlace drive and reset is indicated by JP,4-186217,A. By this approach, the FLC (ferroelectric liquid crystal) panel is driven by the interlace mode, and the scanning line in a non-display period is reset. Thereby, reduction of the scan period by the reset period is prevented. Moreover, since the period of reset of adjacent Rhine shifts, it is thought that a flicker decreases by equalization. However, luminance distribution in a field, reduction of the maximum permeability, etc. which are other problems do not improve by this approach, either.

[0016] Even if a reset pulse is used for the purpose of this invention with the liquid crystal display of a high-speed response in view of the above, there are few dispersion and the flickers of the brightness within a field, and it is offering the drive approach of a liquid crystal display high contrast and high brightness being obtained.

[0017] the high-speed response the above-mentioned drive approach was used for whose purposes of other of this invention -- dispersion within a field and the flicker of brightness -- few -- high contrast -- high -- it is offering a brightness liquid crystal display.

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MEANS

[Means for Solving the Problem] It is characterized by for the liquid-crystal drive approach of this invention to scan the scanning line one by one for every field, to display a screen, they to reset it all at once in the drive approach of the liquid crystal display which resets the scanning line succeedingly, after it scans the scanning line one by one in the 1st field in order to attain the above-mentioned purpose, and to reset all at once [after scanning to the order of a scan and the reverse order in the 1st field in the 2nd field following this 1st field].
[0019] Since time amount until it results [from writing] in reset is equalized in the field of a display panel according to the liquid crystal drive approach of this invention, the uniform luminance distribution within a field is acquired.
[0020] In case an interlace drive is performed by the drive approach of this invention, it is desirable to scan the scanning line of No. odd one by one from a top to the bottom by the 1st frame, and to scan the scanning line of No. even one by one upwards from the bottom by the 2nd frame.
[0021] It is also the desirable modes of this invention to face to perform an interlace drive and to have 2 times of write-in periods with the one scanning line in one frame and to have 2 times of reset periods. Here, it has 1 time of a reset period with the one scanning line in one frame, and it can constitute so that smaller than the absolute value of the data signal electrical potential difference at the time of the writing whose absolute value of the data signal electrical potential difference at the time of the 1st writing after reset is the 2nd time.
[0022] The liquid crystal display of this invention is a liquid crystal display which adopts the liquid crystal drive approach of above-mentioned this invention, and the operation and effectiveness corresponding to this invention approach are acquired.
[0023]
[Embodiment of the Invention] Hereafter, with reference to a drawing, this invention is further explained to a detail based on the example of an operation gestalt of this invention. Drawing 1 is drawing to show the drive approach of the 1st operation gestalt of this invention, and this drawing (a) is a timing diagram which shows the configuration of the time amount allocation for every scanning line. An axis of abscissa is a time-axis and an axis of ordinate is a scanning-line shaft. This drawing shows the example of the eight scanning lines. Moreover, this drawing (b) is the timing diagram which shows the scanning-line electrical potential difference in the scanning line of No. 1 (1 Motome) in (a), and its transmission, and this drawing (c) is a timing diagram which shows the scanning-line electrical potential difference and transmission in the scanning line of No. 8 (last).
[0024] In this example of an operation gestalt, in the write-in period 101, after choosing each scanning line one by one and writing in data, it displays by shifting to the display period 102, and each scanning lines are succeedingly reset all at once in the reset period 103. Here, the sequence which scans the scanning line differs in the 1st field and the 2nd field in one frame. That is, in the 1st field, from the scanning line of No. 1 to the scanning line of No. 8, it scans one by one toward the bottom from a top, and scans from the bottom toward a top from the scanning line of No. 8 to the scanning line of No. 1 in the 2nd field. In addition, it is good even if respectively reverse in the scan sequence of the 1st field and the 2nd field.
[0025] As shown in drawing 1 (b), in the scanning line of No. 1, the scan signal for writing is impressed in early stages of the 1st field, and the scan signal for reset is impressed at the time of the field termination. Moreover, in the 2nd field, the scan signal for writing is conversely impressed to the last stage, and the scan signal for reset is impressed at the time of termination of the field. On the other hand, as shown in drawing 1 (c), in the scanning line of No. 8, the scan signal for writing is impressed to the last stage of the 1st field, and the scan signal for reset is impressed at the time of termination of the field. Moreover, in the 2nd field, the scan signal for writing is conversely impressed to the first stage, and the scan signal for reset is impressed at the time of termination of the field. In addition, in the example shown in drawing 1 (b) and (c), although the write-in signal is made into the signal of a white display (high permeability) and being considered as the signal of a black display (low permeability) at the time of reset, the permeability at the time of writing itself differs according to actual write-in data.

[0026] With the scanning line of No. 1, permeability begins to rise from the early stages of the 1st field, the maximum permeability is reached after write-in termination, and it becomes the minimum permeability in the reset period at the time of field termination. Moreover, in the 2nd field, permeability begins to rise conversely in the last stage, the maximum permeability is reached after write-in termination, and it becomes the minimum permeability in the reset period just behind that. On the other hand, with the scanning line of No. 8, permeability begins to rise from the last stage of the 1st field, the maximum permeability is reached after write-in termination, and it becomes the minimum permeability in the reset period just behind that. Moreover, in the 2nd field, permeability begins to rise the first stage conversely, the maximum permeability is reached after write-in termination, and it becomes the minimum permeability in the reset period at the time of field termination.

[0027] Drawing 2 (a) is a brightness distribution map within a field between each ** of the liquid crystal display panel in the example shown in drawing 1 , when the same sign shows Screens 1A, 1B, and 1C in drawing 1 (a), they correspond, respectively, and it shows each luminance distribution at the time of the write-in anaphase and the 1st field last stage at the time in early stages of [write-in] the 1st field. Moreover, when the same sign shows Screens 1D, 1E, and 1F in drawing 1 (a), they correspond, respectively, and each luminance distribution at the time of the write-in anaphase and the 2nd field last stage is shown at the time in early stages of [write-in] the 2nd field. Drawing 2 (b) is the luminance distribution actually observed, i.e., the luminance distribution by which the time average was carried out over frame time. As shown in drawing 2 (a), it corresponds to permeability change of drawing 1 (c), and the panel upper part becomes brighter than the lower part, and the panel lower part becomes brighter than the upper part by 1D and 1E of the 2nd field at 1A and 1B of the 1st field. Moreover, in the field last stages 1C and 1F, the 1st and 2nd fields serve as a black display. Thus, between each **, although the luminance distribution within a field is large, the difference in the luminance distribution within a field is equalized and the brightness within a field observed is uniform so that he can understand these brightness by drawing 2 (b) which carried out the time average.

[0028] Drawing 3 (a) - (c) is a timing diagram which shows the 2nd example of an operation gestalt of this invention with the same method of presentation as drawing 1 (a) - (c), respectively. Although the bidirectional scan is performed like the 1st example of an operation gestalt in this example of an operation gestalt, in that arrangement of a reset period differs, and performing the interlace drive, it differs from the 1st example of an operation gestalt. In this example of an operation gestalt, the moiety (No. odd) of Uchi of all the eight scanning lines is scanned in the 1st field (selection), and the remaining moieties (No. even) are scanned in the 2nd field. The reset period 103 in each scanning line is arranged at the time of termination of the field of the not scanning (selection). That is, the scanning line of No. odd has the write-in period 101 all over the 1st field, it scans one by one from a top, writing is performed, the display period 102 continues after that, and the reset period 103 is established at the time of termination of the 2nd field. On the other hand, the reset period 103 is established at the time of the 1st field termination, the scanning line of No. even has the write-in period 101 all over the 2nd field, it scans one by one from the bottom, writing is performed, the display period 102 continues after that, and the next reset period is established at the time of the 1st field termination of the following frame (not shown).

[0029] In the 1st field, the odd-numbered scanning line is scanned one by one from a top from a top, and the even-numbered scanning line is scanned one by one from the bottom from a top in the 2nd field. That is, in the scanning line of No. 1, the scan signal for writing is impressed in early stages of the 1st field, and the scan signal for reset is impressed at the time of termination of the 2nd field. For this reason, permeability begins to rise from the early stages of the 1st field, the maximum permeability is reached after write-in termination, and it becomes the minimum permeability in the reset period at the time of termination of the 2nd field. On the other hand, in the scanning line of No. 8, the scan signal for reset is impressed at the time of termination of the 1st field, and the scan signal for writing is impressed to it in early stages of the 2nd field. For this reason, it becomes the minimum permeability at the time of termination of the 1st field, permeability begins to rise in early stages of the 2nd field, and the maximum permeability is reached after write-in termination.

[0030] Drawing 4 (a) and (b) indicate similarly the luminance distribution of the 2nd example of an operation gestalt to be drawing 2 (a) and (b), respectively. Screens 2A-2F in this drawing (a) correspond at each [which is shown with the same sign in drawing 3 (a)] time. As shown in drawing 4 (a), it corresponds to permeability change of drawing 3 (c), and the scanning line of No. even is always bright in an anaphase the early stages of writing, and write-in, and the scanning line of No. odd is brighter than the lower part in the panel upper part in the 1st field. On the other hand, the scanning line of No. odd is always bright in an anaphase the early stages of writing, and write-in, and the scanning line of No. even has the panel lower part brighter than the upper part in the 2nd field. Moreover, in the field last stage, the scanning line of No. even becomes black, as for the 1st field, the scanning line of No. odd becomes white, the scanning line of No. odd becomes black and, as for the 2nd field, the even-numbered scanning line becomes white. Thus, between each **, although the luminance distribution within a field is large, the difference in the luminance distribution within a field is greatly eased so that he can understand this property by drawing 4 (b) which carried out the time

average. Here, although the stripes of light and darkness arise in the panel upper part and the lower part corresponding to the scanning line, in the panel center section, these stripes do not have **********. On an actual screen, since the pitch of the scanning line is fine, the stripes of this light and darkness are averaged spatially, and an almost uniform display is obtained over a face of panel.

[0031] In the 2nd example of an operation gestalt, it has the advantage that brightness is very high compared with the brightness of drawing 2 (b) of the 1st operation gestalt. Furthermore, since a flicker is generated for every Rhine of the odd number of an interlace drive, and even number, the flicker observed decreases by the equalization between Rhine. Moreover, the point that the period when a full screen becomes a black display does not exist at all also has effectiveness in reduction of a flicker.

[0032] Drawing 5 (a) - (c) is a timing diagram which shows the 3rd example of an operation gestalt of this invention with the same method of presentation as drawing 1 (a) - (c), respectively. With this operation gestalt, the bidirectional scan is performed by the interlace drive like the 2nd example of an operation gestalt, and it is equivalent to the drive approach which doubled the frame frequency of the 2nd example of an operation gestalt. That is, as shown in this drawing (a), the scanning line of No. odd has the write-in period 101 during the first half of the 1st field, it scans one by one from a top, writing is performed, the display period 102 continues after that, and the reset period 103 is established at the time of termination of the field. Time amount allocation also of the 2nd field is carried out similarly. On the other hand, the reset period 103 is established at the time of first half termination of the 1st field, the scanning line of No. even has the write-in period 101 in the second half of the field, a scan is performed one by one from the bottom, and the display period 102 continues after that. Time amount allocation also of the 2nd field is carried out similarly, and a reset period is established after that at the time of first half termination of the 1st field of the following frame (not shown).

[0033] As the scanning line of No. 1 is shown in drawing 5 (b), the scan signal for reset is impressed in early stages of the 1st field for the scan signal for writing, and the scan signal for reset is impressed for the scan signal for writing in early stages of the 2nd field, respectively at the time of the 2nd field termination at the time of the 1st field termination. By this, permeability begins to rise from the early stages of the 1st field, the maximum permeability is reached after write-in termination, and it becomes the minimum permeability in the reset period at the time of termination of the 1st field, and permeability begins to rise from the early stages of the 2nd field, the maximum permeability is reached after write-in termination, and it becomes the minimum permeability in the reset period at the time of termination of the 2nd field. On the other hand, as the scanning line of No. 8 is shown in drawing 5 (c), at the time of the termination in the first half of the 1st field, the scan signal for writing is impressed to the first stage in the second half of the 1st field for the scan signal for reset, and the scan signal for writing is impressed for the scan signal for reset to the first stage in the second half of the 2nd field, respectively at the time of the termination in the first half of the 2nd field. By this, it becomes the minimum permeability at the time of the termination in the first half of the 1st field, and permeability begins to rise in early stages in the second half of the 1st field, the maximum permeability is reached after write-in termination, it becomes the minimum permeability at the time of the termination in the first half of the 2nd field, permeability begins to rise in early stages in the second half of the 2nd field, and the maximum permeability is reached after write-in termination.

[0034] Drawing 8 (a) is luminance distribution which is actually observed in the example of an operation gestalt of the above 3rd and by which the time average was carried out over frame time. The luminance distribution within the field seen by the conventional drive approach of drawing 15 (b) is eased. In this example of an operation gestalt, since the reset period of 2 times is prepared in 1 inter-frame, the brightness as the example of an operation gestalt of ** a 2nd is not obtained. Although the other descriptions are the same as that of the 2nd example of an operation gestalt, electric asymmetry differs greatly. In the writing of the 1st operation gestalt of drawing 1 , the die length of the display period 102 of the 1st field and the 2nd field differs in many cases. This tends to produce the electric asymmetry of the anti-electric-field reason which polarization generates in the case of the liquid crystal which has spontaneous polarization like a ferroelectric liquid crystal or antiferroelectricity liquid crystal, and becomes causes, such as seizure of an ion reason. Moreover, in the writing of the 2nd example of an operation gestalt of drawing 3 , since there is only one writing into one frame, the electric asymmetry according to the polarity of a data signal arises. On the other hand, since the die length of the display period 102 of the 1st field and the 2nd field is the same and both polar data signals can be written in in this example of an operation gestalt corresponding to each field, there is no electric asymmetry and it does not have generating of printing.

[0035] Drawing 6 (a) - (c) is a timing diagram which indicates the 4th example of an operation gestalt similarly to be drawing 1 (a) - (c), respectively. In this example of an operation gestalt, an interlace drive is carried out in the field of what is an interlace drive like the 2nd and 3rd examples of an operation gestalt, and is performing the bidirectional scan, and the fields differ from the example of an operation gestalt of these points in the point used as the relation of a bidirectional scan. That is, the scanning line of No. odd has the write-in period 101 during the first half of the 1st field, it scans one by one from a top, the display period 102 continues after that, and the reset period 103 is established at the

time of the 1st field termination. Subsequently, the write-in period 101 is during the first half of the 2nd field, it scans one by one from the bottom, the display period 102 continues after that, and the reset period 103 is established at the time of the 2nd field termination. On the other hand, the reset period 103 is established at the time of first half termination of the 1st field, the scanning line of No. even has the write-in period 101 during the second half of the field, it is scanned one by one from a top, and the display period 102 continues after that. Then, the reset period 103 is established at the time of first half termination of the 2nd field, the write-in period 101 is during the second half of the field, it is scanned one by one from the bottom, the display period 102 continues after that, and a reset period is established at the time of first half termination of the 1st field of the following frame (not shown).

[0036] In the scanning line of No. 1, as shown in drawing 6 (b), the scan signal for reset is impressed in early stages of the 1st field for the scan signal for writing, and the scan signal for reset is impressed for the scan signal for writing in the last stage of the 2nd field, respectively at the time of the 2nd field termination at the time of the 1st field termination. By this, permeability begins to rise from the early stages of the 1st field, the maximum permeability is reached after write-in termination, and it becomes the minimum permeability in the reset period at the time of termination of the 1st field, and permeability begins to rise from the last stage in the first half of the 2nd field, the maximum permeability is reached after write-in termination, and it becomes the minimum permeability in the reset period at the time of termination of the 2nd field. On the other hand, in the scanning line of No. 8, as shown in drawing 6 (c), at the time of the termination in the first half of the 1st field, the scan signal for writing is impressed to the last stage in the second half of the 1st field for the scan signal for reset, and the scan signal for writing is impressed for the scan signal for reset to the first stage in the second half of the 2nd field, respectively at the time of the termination in the first half of the 2nd field. Thereby, as shown in drawing 6 (c), it becomes the minimum permeability at the time of the termination in the first half of the 1st field, permeability begins to rise in the second half of the 1st field in the last stage, the maximum permeability is reached after write-in termination, it becomes the minimum permeability at the time of the termination in the first half of the 2nd field, permeability begins to rise in early stages in the second half of the 2nd field, and the maximum permeability is reached after write-in termination.

[0037] Drawing 8 (b) shows the luminance distribution which is actually observed in this example of an operation gestalt and by which the time average was carried out over frame time. In this example of an operation gestalt, the luminance distribution within the field seen in the conventional drive approach of drawing 15 (b) or the 3rd example of an operation gestalt of drawing 8 (a) is lost. Consequently, the stripes of the light and darkness seen in the 2nd and 3rd examples of an operation gestalt do not occur. Moreover, since a flicker is generated for every Rhine of the odd number and even number of an interlace drive unlike the 1st operation gestalt of drawing 2 (b) which does not have luminance distribution into a field similarly, the flicker observed decreases by the equalization between Rhine. Moreover, the point that the period when a full screen becomes a black display does not exist at all also has effectiveness in reduction of a flicker. Furthermore, since the substantial frequency is high, while the difference of the die length of the display period of the 1st field and the 2nd field becomes one half extent as compared with the 1st example of an operation gestalt as compared with the 1st example of an operation gestalt of drawing 1 , two writing is possible within one frame. Consequently, there are few differences of the die length of the display period 102 of the 1st field and the 2nd field, and since both polar data signals can be written in corresponding to each field, it is hard to be generated and electric asymmetry has little generating of printing.

[0038] Drawing 7 (a) - (c) is a timing diagram which indicates similarly the 5th example of an operation gestalt of this invention to be drawing 1 (a) - (c), respectively. this example of an operation gestalt -- the 2- an interlace drive is carried out in the field of what is performing the bidirectional scan by the interlace drive like the 4th example of an operation gestalt, and a bidirectional scan is performed, and the fields serve as relation of a bidirectional scan. That is, the scanning line of No. odd has the write-in period 101 during the first half of the 1st field, it scans one by one from a top, the display period 102 continues after that, and the reset period 103 is established at the time of field termination. Subsequently, the write-in period 101 is during the first half of the 2nd field, it scans one by one from the bottom, the display period 102 continues after that, and the reset period 103 is established at the time of field termination. On the other hand, the reset period 103 is established at the time of first half termination of the 1st field, the scanning line of No. even has the write-in period 101 during the second half of the field, it is scanned one by one from the bottom, and the display period 102 continues after that. Subsequently, the reset period 103 is established at the time of first half termination of the 2nd field, the write-in period 101 is during the second half of the field, it is scanned one by one from a top, the display period 102 continues after that, and a reset period is established at the time of first half termination of the 1st field of the following frame (not shown).

[0039] In the scanning line of No. 1, as shown in drawing 7 (b), the scan signal for reset is impressed in early stages of the 1st field for the scan signal for writing, and the scan signal for reset is impressed for the scan signal for writing in the last stage of the 2nd field, respectively at the time of the 2nd field termination at the time of the 1st field termination. By this, permeability begins to rise from the early stages of the 1st field, the maximum permeability is

reached after write-in termination, and it becomes the minimum permeability in the reset period at the time of termination of the 1st field, and permeability begins to rise from the last stage in the first half of the 2nd field, the maximum permeability is reached after write-in termination, and it becomes the minimum permeability in the reset period at the time of termination of the 2nd field. On the other hand, in the scanning line of No. 8, as shown in drawing 7 (c), at the time of the termination in the first half of the 1st field, the scan signal for writing is impressed to the first stage in the second half of the 1st field for the scan signal for reset, and the scan signal for writing is impressed for the scan signal for reset in the last stage in the second half of the 2nd field, respectively at the time of the termination in the first half of the 2nd field. By this, it becomes the minimum permeability at the time of the termination in the first half of the 1st field, and permeability begins to rise in early stages in the second half of the 1st field, the maximum permeability is reached after write-in termination, it becomes the minimum permeability at the time of the termination in the first half of the 2nd field, permeability begins to rise in the second half of the 2nd field in the last stage, and the maximum permeability is reached after write-in termination. The brightness distribution map within the panel side by which the time average was carried out over frame time actually observed with the operation gestalt from a book is the same as that of drawing 8 (b) which shows the 4th operation gestalt. The other descriptions are the same as that of the 4th example of an operation gestalt.

[0040] Drawing 9 (a) is a timing diagram which indicates similarly the 6th example of an operation gestalt of this invention to be drawing 1 (a). this example of an operation gestalt -- the 2- it is the scan timing when using the data signal electrical potential difference shown by drawing 17 of what currently is performing the bidirectional scan by the interlace drive like the 5th example of an operation gestalt, and differs from the previous example of an operation gestalt in the point that 2 times of the write-in periods 101 and 1 time of the reset period 103 exist in one frame. That is, the scanning line of No. odd has the write-in period 101 during the first half of the 1st field, it scans one by one from a top, and the display period 102 continues after that. Subsequently, the write-in period 101 is during the first half of the 2nd field, it scans one by one from a top, the display period 102 continues after that, and the reset period 103 is established at the time of field termination. On the other hand, the reset period 103 is established in the middle of the 1st field, the scanning line of No. even has the write-in period 101 during the second half of the field, it is scanned one by one from the bottom, and the display period 102 continues after that. Subsequently, the write-in period 101 is during the field second half of the 2nd field, it is scanned one by one from the bottom, the display period 102 continues after that, and a reset period is established in the middle of the 1st field of the following frame (not shown).

[0041] Drawing 9 (b) is luminance distribution which is actually observed in this example of an operation gestalt and by which the time average was carried out over frame time. Although the luminance distribution within the field seen by the conventional drive approach of drawing 15 (b) is eased, in the panel upper part and the lower part, the stripes of light and darkness arise corresponding to the scanning line. In the panel center section, these stripes are hardly produced. When the pitch of the scanning line is fine, the stripes of this light and darkness are averaged spatially, and an almost uniform display is obtained over the whole panel surface. Moreover, compared with conventional drawing 15 (b) and drawing 2 (b) of the 1st operation gestalt, brightness is very high. Furthermore, since the time amount from a reset period to the next write-in period is short compared with the 2nd operation gestalt, high brightness is obtained. Furthermore, since it generates for every Rhine of the odd number and even number of an interlace drive, the flicker observed reduces a flicker by the equalization between Rhine. Moreover, the point that the period when a full screen becomes a black display does not exist also has effectiveness in reduction of a flicker.

[0042] Drawing 9 (c) is a timing diagram which indicates similarly the 7th example of an operation gestalt of this invention to be drawing 1 (a). although this example of an operation gestalt is the same as the 6th example of an operation gestalt almost -- the scanning direction of the 2nd field -- differing -- the 2- the same interlace drive as the 5th operation gestalt -- and the bidirectional scan is performed. That is, the scanning line of No. odd has the write-in period 101 during the first half of the 1st field, it scans one by one from a top, and the display period 102 continues after that. Subsequently, the write-in period 101 is during the first half of the 2nd field, it scans one by one from the bottom, the display period 102 continues after that, and the reset period 103 is established at the time of field termination. On the other hand, the reset period 103 is established in the middle of the 1st field, the scanning line of No. even has the write-in period 101 during the second half of the field, it is scanned one by one from the bottom, and the display period 102 continues after that. Then, the write-in period 101 is during the field second half of the 2nd field, it is scanned one by one from a top, the display period 102 continues after that, and a reset period is established in the middle of the 1st field of the following frame (not shown). The luminance distribution of the panel by which the time average was carried out is the same as that of drawing 9 (b) of the 9th example of an operation gestalt.

[0043] Drawing 10 (a) is a timing diagram which shows the 8th example of an operation gestalt of this invention. In this example of an operation gestalt, it is premised on performing a field sequential display, and, in addition to the timing diagram of drawing 1 (a), the brightness which carries out incidence to the panel of the light source as one of the axes of ordinate is shown. The light source is scanned in order of red, green, and blue in this drawing. In addition, this

sequence can be changed to arbitration corresponding to exchange of a data signal. The light source does not carry out incidence of during the reset period of the scanning line to a panel side, and this period turns into a period changed to other colors. Although it is the same as that of the scan timing when using the data signal electrical potential difference of drawing 17 about a scan, since it is a field sequential display, 3 times of the reset periods 103 exist in one frame. During the scan of each color, 2 times of the write-in periods 101 are established, and the data signal of positive/negative is distributed and impressed to each write-in period for every sign. The reset period 103 prepares after two writing, and it is ****. The group which consists of this two writing and one reset is repeated 3 times synchronizing with each color. It is possible for the information on each color to be displayed into one frame, and to perform color display per 1 pixel as a result of the scan of these light sources and the scanning line. Since the count of a reset period is one half compared with the case where a field sequential display is performed by repeating the drive approach of conventional drawing 14 3 times, the high display of brightness is possible. In addition, the luminance distribution within a panel side observed serves as a display with a dark bottom of screen like drawing 15 (b).

[0044] Drawing 10 (b) is a timing diagram which indicates similarly the 9th example of an operation gestalt of this invention to be drawing 10 (a). The light source is scanned in order of red, green, and blue like the 8th operation gestalt. In addition, this sequence can be changed to arbitration corresponding to exchange of a data signal. This example of an operation gestalt differs from the 8th example of an operation gestalt in the point that the light source is made into the period which does not carry out incidence of during a period until a display 1st during a write-in period is stabilized not only after during the reset period of the scanning line but after reset to a panel side, and is changed to other colors. That is, after the shift to a new display condition from a reset condition is completed from the panel upper part to the lower part, incidence of the light of the light source is carried out to a panel, and it is recognized by the observer. By this approach, the luminance distribution within a panel side seen with the 8th operation gestalt is lost, and uniform brightness is obtained by the full screen. Drawing 18 is a timing diagram which shows time amount allocation of the brightness of the light source of the gestalt for abolishing the luminance distribution within a panel side by the conventional field sequential display, the configuration of the time amount allocation for every scanning line, and actuation. After reset finishes and a write-in display is stabilized conventionally, the time amount which carries out incidence of the light from the light source to a panel, and makes the light source turn on is very short. On the other hand, since light source lighting time amount can secure for a long time in this example of an operation gestalt, the brightness of the whole panel is high.

[0045] Drawing 11 is a timing diagram which indicates similarly the 10th example of an operation gestalt of this invention to be drawing 9 (a). The light source is scanned in order of red, green, and blue. In addition, this sequence can be changed to arbitration corresponding to exchange of a data signal. About a scan, although it is the same as that of the scan timing of a bidirectional scan of the 1st operation gestalt of drawing 1 , since it is a field sequential display, 3 times of the reset periods 103 exist in one frame. During the scan of each color, 2 times of the write-in periods 101 are established, and the data signal of positive/negative is distributed and impressed to each write-in period for every sign. Each write-in period 101 corresponds to the bidirectional scan of the scan from a top, and the scan from the bottom. In drawing 11 , when the light source is red, for example, the scan from a top is performed and, subsequently the group which consists of two writing and two reset is repeated 3 times like a reset period, the scan from the bottom, and a reset period synchronizing with each color. Here, one writing and one reset will be called a subfield. The 1st subfield and 2nd subfield exist to each color, this group is repeated 3 times by making these into a group, and one frame is constituted. The light is switched on with the beginning of the 1st subfield, the light source is switched off just before the reset period of the 2nd subfield, and a change in other colors is performed during a reset period. It is possible for the information on each color to be displayed into one frame, and to perform color display per 1 pixel as a result of the scan of these light sources and the scanning line. It is not necessary to adjust the lighting time amount of the light source like the 9th example of an operation gestalt, and there is no luminance distribution in a panel side for the same bidirectional scan as the 1st operation gestalt. Moreover, since the light source lighting period is longer than the conventional approach of drawing 18 , brightness is high. Furthermore, although it is necessary to turn the light source on and off for every subfield in drawing 18 , the need does not exist with this operation gestalt.

[0046] The 11th example of an operation gestalt of this invention is the liquid crystal display which used either of the drive approaches of the 1st to 7th example of an operation gestalt. Drawing 12 is the top view in which showing the liquid crystal display of this example of an operation gestalt, and showing the TFT (thin film transistor) array on one substrate. The substrate of this example of an operation gestalt consists of a TFT substrate and an opposite substrate, and as shown in drawing 12 , a TFT substrate has two or more gate bus lines 3, two or more drain bus lines 1, and the array that consists of two or more TFT1, and has at least one pixel electrode 4 in each pixel. Drawing 13 is the mimetic diagram showing the cross section of the liquid crystal display of this example of an operation gestalt. An electrode 7 is formed on each of two support substrates 6, and the orientation film 8 to which orientation of the liquid crystal is carried out is formed on it. Between the support substrates 6 of this pair, liquid crystal 9 is pinched and the polarizing

plate 5 of a pair is formed outside.
[0047] The actuation of this operation gestalt is as follows. The signal data wave corresponding to each drive approach is impressed to each drain bus line 1 with predetermined frequency corresponding to each gate line 3. On the other hand, when the Rhine is chosen as each gate bus line 3, the wave shown in each example of an operation gestalt which turns on the switch of TFT2 is impressed to it, and thereby, the wave of the drain line 1 is impressed to liquid crystal with a display electrode. An electrical potential difference is held at the liquid crystal section until the gate line 3 is chosen again. Even if liquid crystal does not have memory nature by this, maintenance actuation of a display is possible. A wave which reset impresses the predetermined signal data for reset to the drain line 1, and turns on the switch of TFT1 is impressed to the timing shown with each operation gestalt. Thereby, the liquid crystal display which applied one drive approach of the 1st to 7th example of an operation gestalt of this invention is realized.
[0048] The 12th example of an operation gestalt of this invention has the same structure with having been shown in drawing 13 , and is a liquid crystal display using either of the drive approaches of the 8th to 10th example of an operation gestalt. An electrode 7 is formed on each of two support substrates 6, and the orientation film 8 to which orientation of the liquid crystal 9 is carried out is formed on it. Between the support substrates of this pair, liquid crystal 9 is pinched and the polarizing plate 5 of a pair is formed outside. Furthermore, one polarizing plate 5 side is equipped with the light source which is not illustrated for a field sequential display. The liquid crystal display which applied one drive approach of the 8th to 10th example of an operation gestalt is realized by this configuration.
[0049] In the liquid crystal display of the 11th and 12th examples of an operation gestalt, offset or the configuration eased on the whole is used for the 13th example of an operation gestalt of this invention for the luminance distribution within a panel side by the viewing-angle dependency and the drive approach which liquid crystal display mode has. Luminance distribution within panel side ** which originates in the viewing-angle dependency which liquid crystal display mode has, and the drive approach by this configuration is eased, and the liquid crystal display of a very good display is realized.
[0050] Hereafter, the example of a concrete configuration of the liquid crystal display which actually applied the above-mentioned example of an operation gestalt of this invention is shown as each example.
[0051] The 1st example: Using the chromium (Cr) formed in 480 gate bus lines and 640 drain bus lines by the spatter, line breadth was set to 10 micrometers and silicon nitride (SiNx) was used for gate dielectric film. Magnitude of a 1 unit pixel was set to 330 micrometers long and 110 micrometers wide, TFT (thin film transistor) was formed using the amorphous silicon, and the pixel electrode was formed by the spatter using the indium oxide tin (ITO) which is a transparent electrode. Thus, the glass substrate which formed TFT in the shape of an array was used as the 1st substrate. After forming the light-shielding film which used chromium, the protective layer which formed the transparent electrode (common electrode) which used ITO, formed the color filter in the shape of a matrix by the staining technique further, and used the silica for that top face was prepared in this 1st substrate and the 2nd substrate which counters. Then, fusibility polyimide was printed by print processes, it baked at 180 degrees C, and the solvent was removed. The buff cloth which used rayon for this polyimide film top was twisted around the roller with a diameter of 50mm, and rubbing was carried out in the direction which serves as parallel rubbing by engine-speed 600rpm of a roller, the stage passing speed of 40mm/second, the amount of pushing of 0.7mm, and two counts of rubbing. The thickness of the orientation film measured with the contact level difference plan was about 500A, and the pre tilt angle measured by the crystal rotation method was 7 times. The sealant of ultraviolet-rays hardenability which true **** (micro pearl) which is the spherical spacer of the diameter of about 9.5 micrometer was sprinkled [sealant] to one side of the glass substrate of such a pair, and made another side distribute the glass rod spacer of the shape of a cylinder of the diameter of about 9.5 micrometer was applied. The sealant was stiffened by the processing which both substrates are made to counter, arranges and irradiates ultraviolet rays by non-contact so that the rubbing processing direction may serve as parallel rubbing mutually in these substrates, and the gap 9.5micrometer panel was assembled. The nematic liquid crystal was poured into this panel. In this example, the compensating plate was added so that it might become the OCB (OPUTIKARI KOMPENSEITIDDO BAIRIFURIJIENSU) display mode shown in 930 pages from 927 pages of S eye dee 94 and a digest. Thus, the driver for a drive was attached in the produced liquid crystal panel, and it considered as the liquid crystal display.
[0052] The drive approach of the 1st operation gestalt was applied with this liquid crystal display. The reset period 103 was made into 5 mses, made the write time of each scanning line 15 microseconds, and, specifically, made 1 field period 16.7 mses. Consequently, the display period of 4.5 ms extent was secured in 1 field also with the scanning line scanned at the end in order of a scan. Addition of the both sides of a bidirectional scan acquired the display period of 16 ms extent in one frame. Moreover, although the speed of response at the time of the standup of this liquid crystal is based also on applied voltage, it is 5 ms extent from several mm, and a response ends it after write-in termination. As liquid crystal display mode, a viewing-angle dependency is hardly extremely seen on a wide-field-of-view square. the place which observed this liquid crystal display, and ** by which the luminance distribution in the panel side by drive

was not observed -- extensive -- the description in angle of visibility liquid crystal display mode was employed efficiently -- extensive -- the angle of visibility display was obtained.

[0053] The 2nd example: The TFT substrate and the color filter substrate were produced like the 1st example. Then, polyamic acid was applied with the spin coat method, it baked and imide-ized at 200 degrees C, and the polyimide film was formed. The buff cloth which used nylon for this polyimide film was twisted around the roller with a diameter of 50mm, and rubbing was carried out in the direction which serves as 10-degree cross rubbing by engine-speed 600rpm of a roller, the stage passing speed of 40mm/second, the amount of pushing of 0.7mm, and two counts of rubbing. The thickness of the orientation film measured with the contact level difference plan was about 500A, and the pre tilt angle measured by the crystal rotation method was 1.5 degrees. The thermosetting sealant which true **** (micro pearl) which is the spherical spacer of the diameter of about 2 micrometer was sprinkled [sealant] to one side of the glass substrate of such a pair, and made another side distribute the glass rod spacer of the shape of a cylinder of the diameter of about 2 micrometer was applied. Both substrates were made to counter, it has arranged, the sealant was stiffened by heat treatment, and the gap 2micrometer panel was assembled so that the rubbing processing direction might serve as 10-degree cross rubbing mutually in these substrates. The antiferroelectricity liquid crystal constituent which carries out V character mold switching shown from 61 pages of the Asia display 95 at 64 pages to this panel was poured in in the state of the 85-degree C isotropic phase (Iso) into the vacuum. While the amplitude impressed the square wave which is **10V by 3kHz and the frequency impressed electric field all over the panel using an arbitration waveform generator and high power amplifier with 85 degrees C, it cooled slowly at the rate of 0.1 degrees C / min to the room temperature. Thus, the driver for a drive was attached in the produced liquid crystal panel, and it considered as the liquid crystal display.

[0054] The drive approach of the 5th operation gestalt was applied with this liquid crystal display. The reset period 103 was made into 1 ms, made the write time of each scanning line 10 microseconds, and 1 field period was made into 16.7 mses, and, specifically, it made the one-frame period 33.4 mses. Consequently, the display period of ten or more mses was secured in 1 field also with the scanning line scanned at the end in order of a scan. Addition of the both sides of a bidirectional scan acquired the display period of 25 mses in one frame. Moreover, although the speed of response at the time of the standup of this liquid crystal is based also on applied voltage, it is about hundreds of microseconds and a response ends it after write-in termination. As liquid crystal display mode, a viewing-angle dependency is hardly extremely seen on a wide-field-of-view square. the place which observed this liquid crystal display, and ** without the luminance distribution in the panel side by drive -- extensive -- the description in angle of visibility liquid crystal display mode was employed efficiently -- extensive -- the angle of visibility display was obtained.

[0055] The 3rd example: The configuration of a liquid crystal panel presupposed that it is the same as the 2nd example. It considered as the field sequential liquid crystal display at this liquid crystal panel using the driver for a drive, and the back light in which high-speed switching is possible.

[0056] With this liquid crystal display, the scan of the drive approach and the brightness of the light source was based on the 10th operation gestalt. The reset period 103 was made into 1 ms, made the write time of each scanning line 5 microseconds, and, specifically, made the one-frame period 33.4 mses. Consequently, the time amount of 6.5 or more mses was acquired at the display period over each color. Moreover, there was no luminance distribution within a panel side.

[0057] The field sequential liquid crystal display which used the same liquid crystal display mode as the 3rd example as an example of a comparison, and used the scan of the drive approach of drawing 18 and the brightness of the light source was used. Although there was no luminance distribution within a panel side as well as the 3rd example, the display period over each color was 4 ms extent, and panel brightness was one half extent of this example of an operation gestalt.

[0058] The 4th example: The micro display was produced as a projector of a reflective mold. It produced like the micro display by the display tech shrine as shown in the beginning of a book of the January, 1997 issue of advanced imaging **. Specifically, DRAM was produced by forming MOS-FET on a silicon wafer in 0.8-micrometer Ruhr. Size etc. is 1/2 inch of die sizes, and formed about pixel pitch 10micrometer and the 1 megger DRAM. The numerical aperture of a pixel was 90% or more. Furthermore, flattening was carried out by giving a chemical mechanical polishing technique to the formed DRAM front face. On the other hand, the cover glass for microscope observation was used for the substrate which counters. The part which includes a drive circuit from a silicon wafer was started, the orientation film by fusibility polyimide was printed, it baked at 170 degrees C, and the solvent was removed. The buff cloth which used nylon for this polyimide film was twisted around the roller with a diameter of 50mm, and rubbing was carried out by engine-speed 600rpm of a roller, the stage passing speed of 40mm/second, the amount of pushing of 0.7mm, and two counts of rubbing. The thickness of the orientation film measured with the contact level difference plan was about 500A, and the pre tilt angle measured by the crystal rotation method was 1.5 degrees. Moreover, the sealant of the photoresist which distributed the glass rod spacer of the shape of a cylinder of the diameter of about 2 micrometer was

applied. These substrates were made to counter and it has arranged, and by carrying out ultraviolet treatment by non-contact, the sealant was stiffened and the gap 2micrometer panel was assembled. The antiferroelectricity liquid crystal constituent which carries out V character mold switching shown from 61 pages of the Asia display 95 at 64 pages to this panel was poured in in the state of the 85-degree C isotropic phase (Iso) into the vacuum. While the amplitude impressed the square wave which is **10V by 3kHz and the frequency impressed electric field all over the panel using an arbitration waveform generator and high power amplifier with 85 degrees C, it cooled slowly at the rate of 0.1 degrees C / min to the room temperature. Furthermore, the reflective mold field sequential projector was produced using the collimate lens, the polarization sensing element, and the lens for projection for obtaining the light emitting diode and parallel light of three colors.

[0059] The drive approach of this liquid crystal display was based on the approach of the 9th example of an operation gestalt. As a result, the good display without the luminance distribution within a field was obtained.

[0060] The 5th example: The TFT substrate and the color filter substrate were produced like the 1st example. Then, fusibility polyimide was printed by print processes, it baked at 180 degrees C, and the solvent was removed. The buff cloth which used rayon for this polyimide film top was twisted around the roller with a diameter of 50mm, and rubbing was carried out in the direction which serves as rubbing 90 degrees by engine-speed 600rpm of a roller, the stage passing speed of 40mm/second, the amount of pushing of 0.7mm, and two counts of rubbing. The thickness of the orientation film measured with the contact level difference plan was about 500A, and the pre tilt angle measured by the crystal rotation method was 3 times. The sealant of ultraviolet-rays hardenability which true **** (micro pearl) which is the spherical spacer of the diameter of about 5.5 micrometer was sprinkled [sealant] to one side of the glass substrate of such a pair, and made another side distribute the glass rod spacer of the shape of a cylinder of the diameter of about 5.5 micrometer was applied. Both substrates were made to counter and it has arranged so that the rubbing processing direction may serve as rubbing 90 degrees mutually in these substrates, and the sealant was stiffened by the processing which irradiates ultraviolet rays by non-contact, and the gap 5.5micrometer panel was assembled. The nematic liquid crystal was poured into this panel. The TN liquid crystal display mode consisted of this examples. Thus, the driver for a drive was attached in the produced liquid crystal panel, and it considered as the liquid crystal display.

[0061] The drive approach of this example performed the conventional drive approach shown by drawing 14 . However, the direction of the viewing-angle dependency of the vertical direction which TN mold display mode has was adjusted, and from above, it became bright at the time of observation, and was made the location which becomes dark from down at the time of observation. Consequently, when a panel was observed from a transverse plane, the luminance distribution and the viewing-angle dependency within the panel side by the drive approach compensated and suited, and the good display was obtained from the conventional panel.

[0062] As mentioned above, although this invention was explained based on the suitable example of an operation gestalt, the liquid crystal drive approach and liquid crystal display of this invention are not limited only to the configuration of the above-mentioned example of an operation gestalt, and an example, and what performed various corrections and modification from the configuration of the above-mentioned example of an operation gestalt and an example is contained in the range of this invention.

[Translation done.]

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DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] It is drawing showing the configuration of the example of an operation gestalt and actuation of the 1st of this invention, and (a) is [the wave form chart of the scanning-line electrical potential difference and permeability of the scanning line of No. 1 and (c of the timing diagram for every scanning line and (b))] the wave form charts of the scanning-line electrical potential difference and permeability of the scanning line of No. 8.
[Drawing 2] The luminance distribution [are the brightness distribution map within a panel side showing actuation of the 1st example of an operation gestalt, and / (a)] between each ** of 1A to 1F of drawing 1 (a) and (b) are the luminance distribution by which the time average was carried out by frame time.
[Drawing 3] It is drawing showing the configuration of the example of an operation gestalt and actuation of the 2nd of this invention, and (a) is [the wave form chart of the scanning-line electrical potential difference and permeability of the scanning line of No. 1 and (c of the timing diagram for every scanning line and (b))] the wave form charts of the scanning-line electrical potential difference and permeability of the scanning line of No. 8.
[Drawing 4] The luminance distribution [are the brightness distribution map within a panel side showing actuation of the 2nd example of an operation gestalt of this invention, and / (a)] between each ** of 2A to 2F of drawing 3 (a) and (b) are the luminance distribution by which the time average was carried out by frame time.
[Drawing 5] It is drawing showing the configuration and actuation of the example of the 3rd operation gestalt of this invention, and (a) is [the wave form chart of the scanning-line electrical potential difference and permeability of the scanning line of No. 1 and (c of the timing diagram for every scanning line and (b))] the wave form charts of the scanning-line electrical potential difference and permeability of the scanning line of No. 8.
[Drawing 6] It is drawing showing the configuration of the example of an operation gestalt and actuation of the 4th of this invention, and (a) is [the wave form chart of the scanning-line electrical potential difference and permeability of the scanning line of No. 1 and (c of the timing diagram for every scanning line and (b))] the wave form charts of the scanning-line electrical potential difference and permeability of the scanning line of No. 8.
[Drawing 7] It is drawing showing the configuration of the example of an operation gestalt and actuation of the 5th of this invention, and (a) is [the wave form chart of the scanning-line electrical potential difference and permeability of the scanning line of No. 1 and (c of the timing diagram for every scanning line and (b))] the wave form charts of the scanning-line electrical potential difference and permeability of the scanning line of the time of No. 8.
[Drawing 8] the 3- of this invention -- it is the luminance distribution Fig. within a panel side showing actuation of the 5th example of an operation gestalt by which the time average was carried out by frame time, and (a) is the 3rd example of an operation gestalt, and (b) is the distribution map of the 4th and 5th examples of an operation gestalt.
[Drawing 9] It is drawing showing the configuration and actuation of the 6th of this invention and the 7th of the example of an operation gestalt, and the brightness distribution map within a panel side where (a) was carried out by the timing diagram for every scanning line of the 6th operation gestalt, and the time average of the (b) was carried out by frame time, and (c) are the timing diagrams for every scanning line of the 7th example of an operation gestalt.
[Drawing 10] It is drawing showing the configuration and actuation of the 8th of this invention and the 9th of the example of an operation gestalt, and (a) is the light source brightness of the 8th example of an operation gestalt, and a timing diagram for every scanning line, and (b) is the light source brightness of the 9th example of an operation gestalt, and a timing diagram for every scanning line.
[Drawing 11] It is drawing showing the configuration of the example of an operation gestalt and actuation of the 10th of this invention, and they are light source brightness and a timing diagram for every scanning line.
[Drawing 12] It is the top view of the thin film transistor array of the liquid crystal display concerning the 11th example of an operation gestalt of this invention.
[Drawing 13] It is the side elevation of the liquid crystal display concerning the 11th example of an operation gestalt.
[Drawing 14] It is drawing showing the conventional drive approach, and (a) is [the wave form chart of the scanning-

line electrical potential difference and permeability of the scanning line of No. 1 and (c of the timing diagram for every scanning line and (b))] the wave form charts of the scanning-line electrical potential difference and permeability of the scanning line of No. 8.

[Drawing 15] It is a brightness distribution map within a panel side by the conventional drive approach, and the luminance distribution [(a)] between each ** of 1A to 1F of drawing 14 (a) and (b) are the luminance distribution by which the time average was carried out by frame time.

[Drawing 16] It is drawing explaining the step response in high-speed response liquid crystal, and (a) is the wave form chart of applied voltage, and (b) is permeability change at the time of the applied voltage of (a).

[Drawing 17] It is drawing explaining the data signal wave for preventing a step response, and (a) is the wave form chart of applied voltage, and (b) is permeability change at the time of the applied voltage of (a).

[Drawing 18] It is drawing showing the drive approach for abolishing the luminance distribution within a panel side by the drive approach of the conventional field sequential liquid crystal display, and the configuration of light source brightness, and they are light source brightness and a timing diagram for every scanning line.

[Description of Notations]

1 Drain Bus Line
2 TFT (Thin Film Transistor)
3 Gate Bus Line
4 Pixel Electrode
5 Polarizing Plate
6 Substrate
7 Electrode
8 Orientation Film
9 Liquid Crystal
101 Write-in Period
102 Display Period
103 Reset Period

[Translation done.]

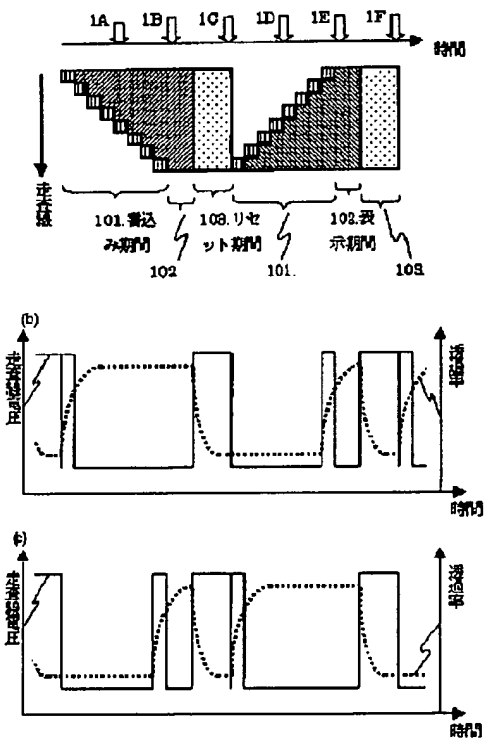
* NOTICES *

Japan Patent Office is not responsible for any damages caused by the use of this translation.

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

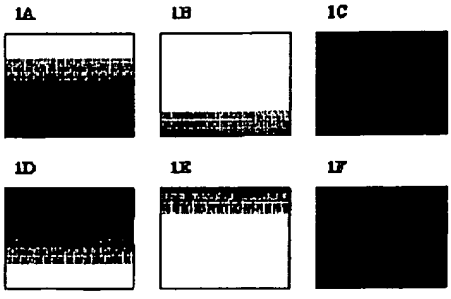
DRAWINGS

[Drawing 1]



[Drawing 2]

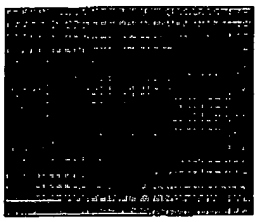
(a) 図1の時間毎のパネル面内輝度分布



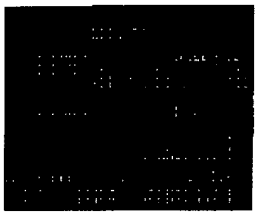
(b) 図1の時間平均した(観察される)パネル面内輝度分

[Drawing 8]

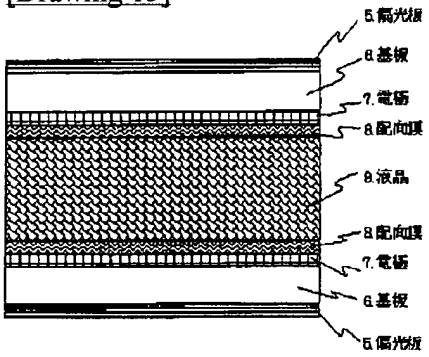
(a)



(b)



[Drawing 13]



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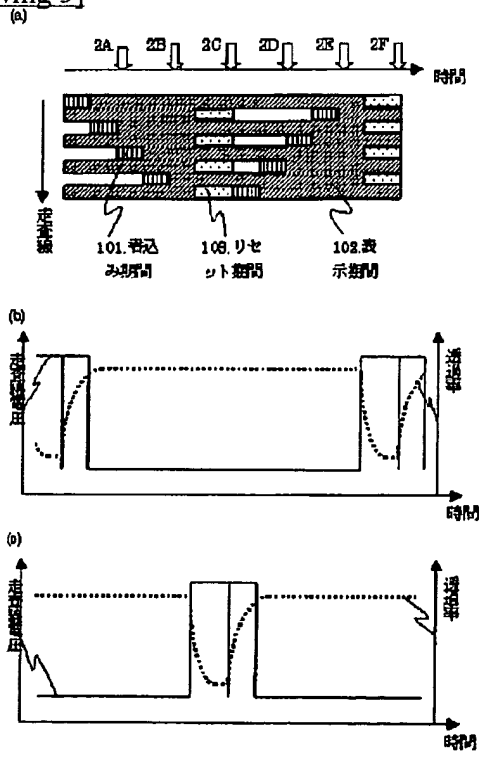
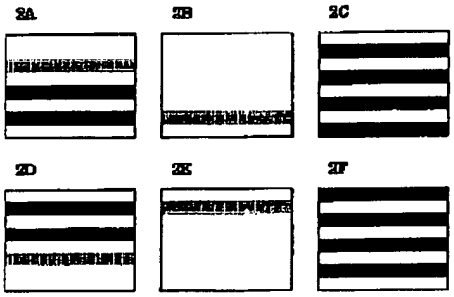
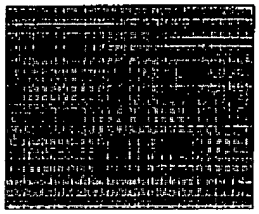


[Drawing 4]

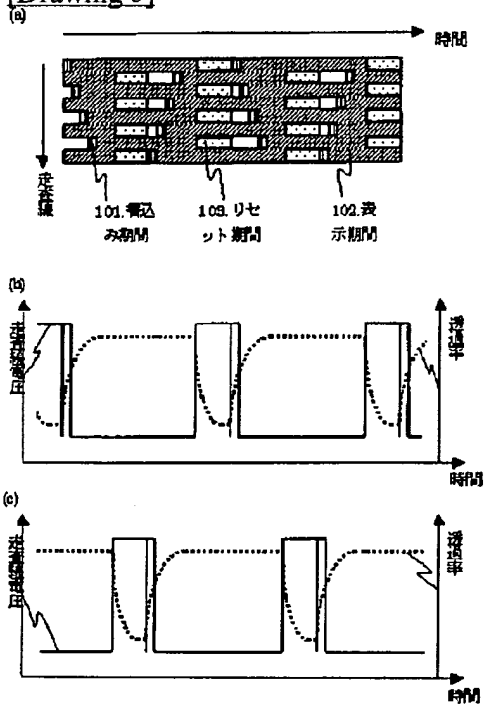
(a) 図３の時間毎のパネル面内輝度分布



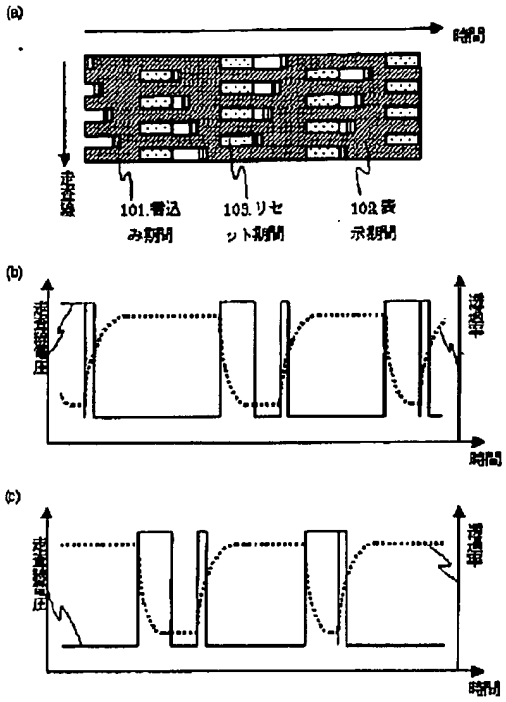
(b) 図３の時間平均した(観察される)パネル面内輝度分布



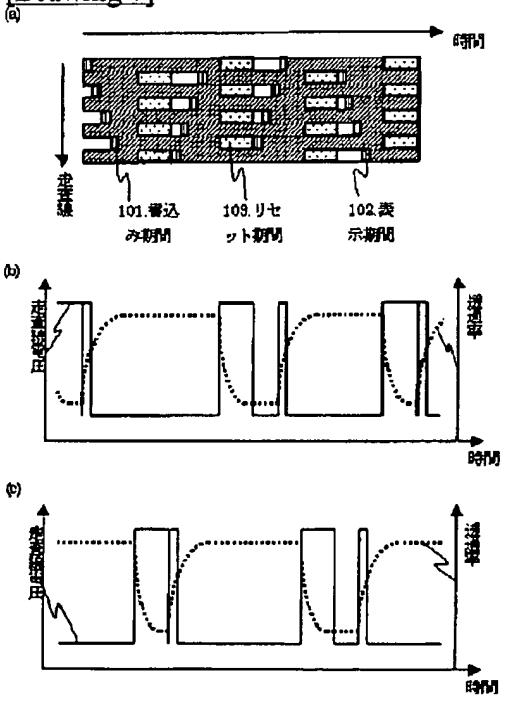
[Drawing 5]



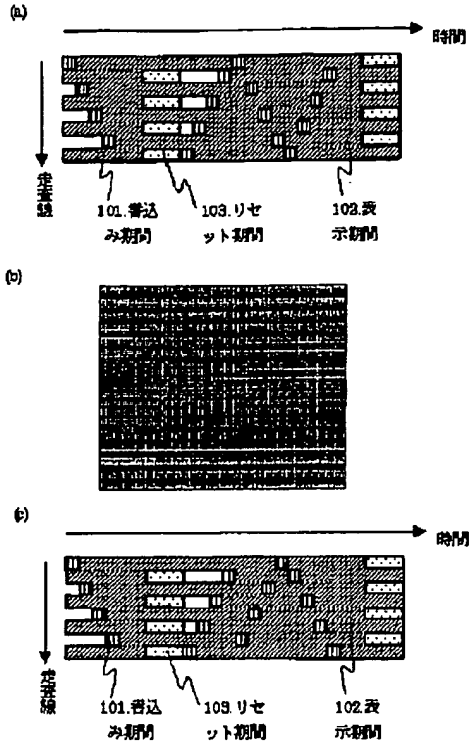
[Drawing 6]



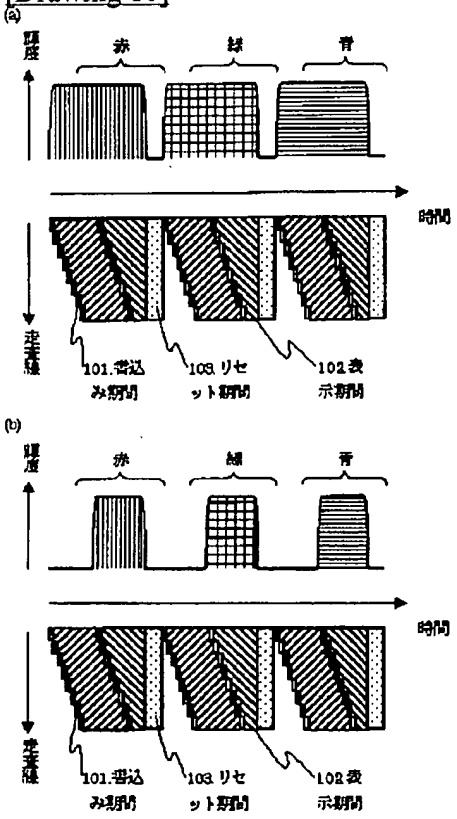
[Drawing 7]



[Drawing 9]



[Drawing 10]



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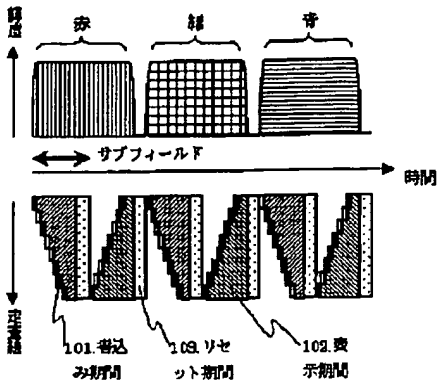
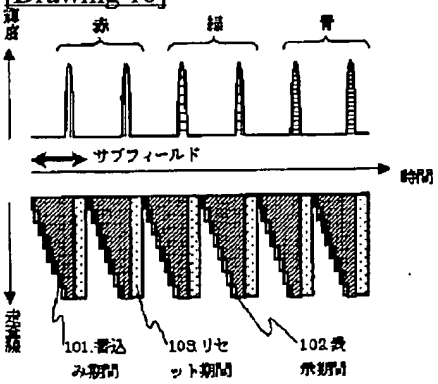
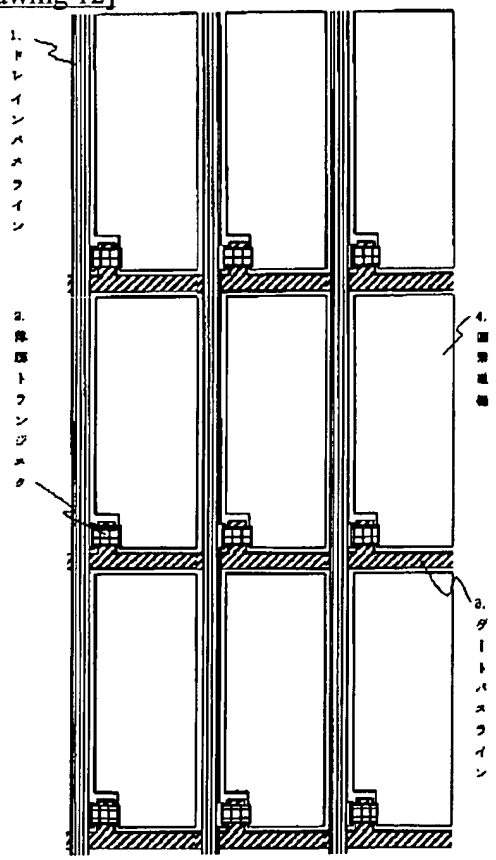


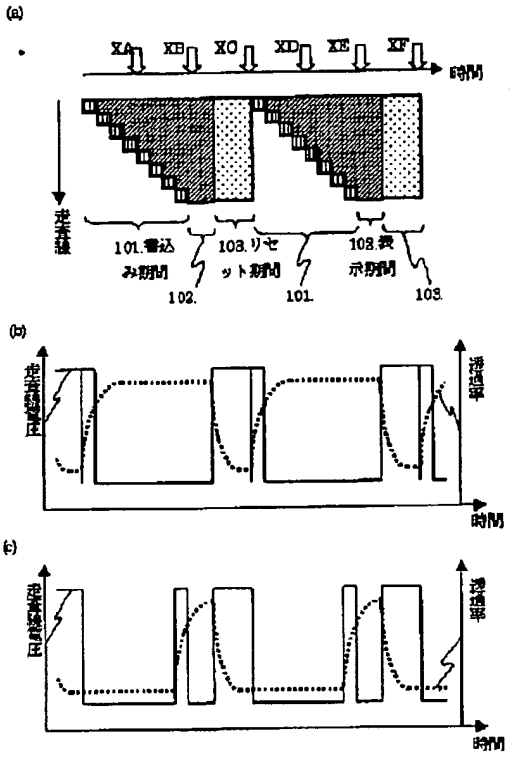
[Drawing 18]



[Drawing 12]

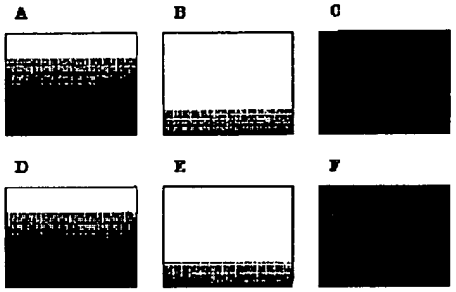


[Drawing 14]



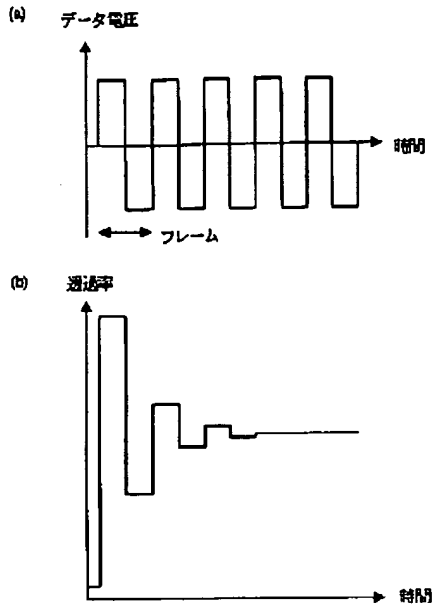
[Drawing 15]

(a)図１４の時間毎のパネル面内輝度分布

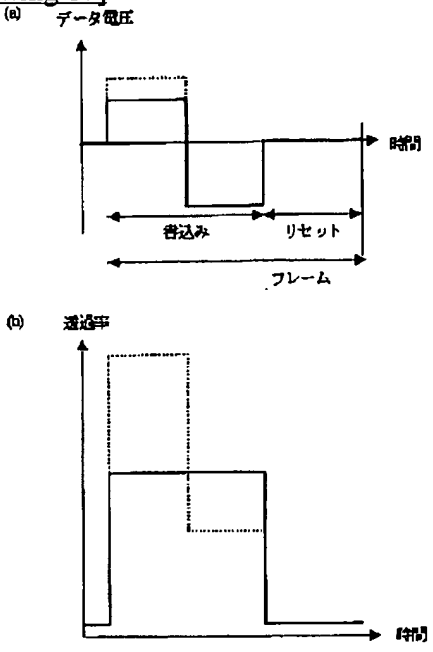


(b)図１４の時間平均した(視認される)パネル面内輝度分布

[Drawing 16]



[Drawing 17]



[Translation done.]